SCIENTIFIC AMERICAN

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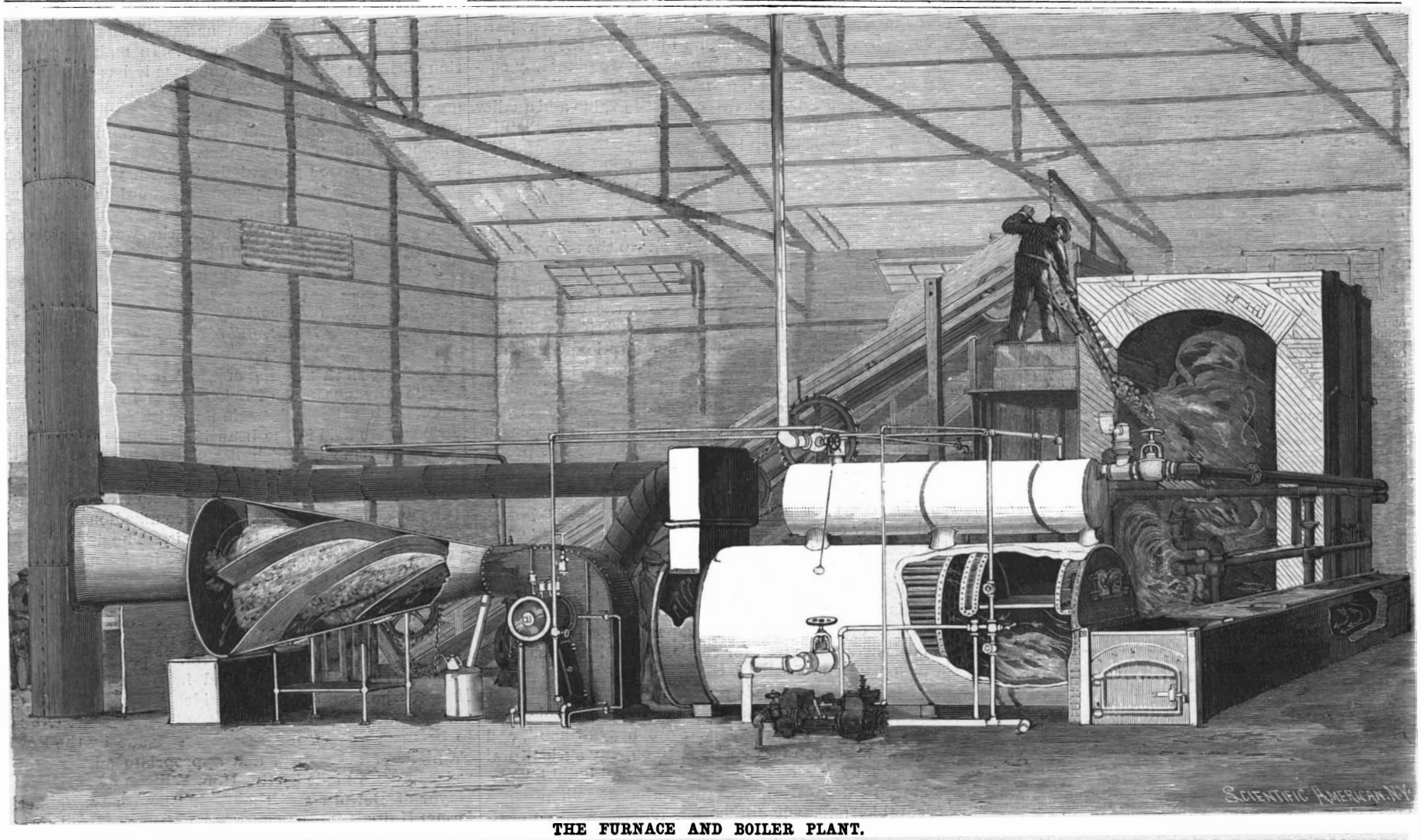

THE FURNACE AND BOILER PLANT.

SORTING TABLE AND FURNACE AT THE "PAPER AND REFUSE" PLANT.

THE DISPOSAL OF THE WASTES OF NEW YORK CITY.—[See page 136.]

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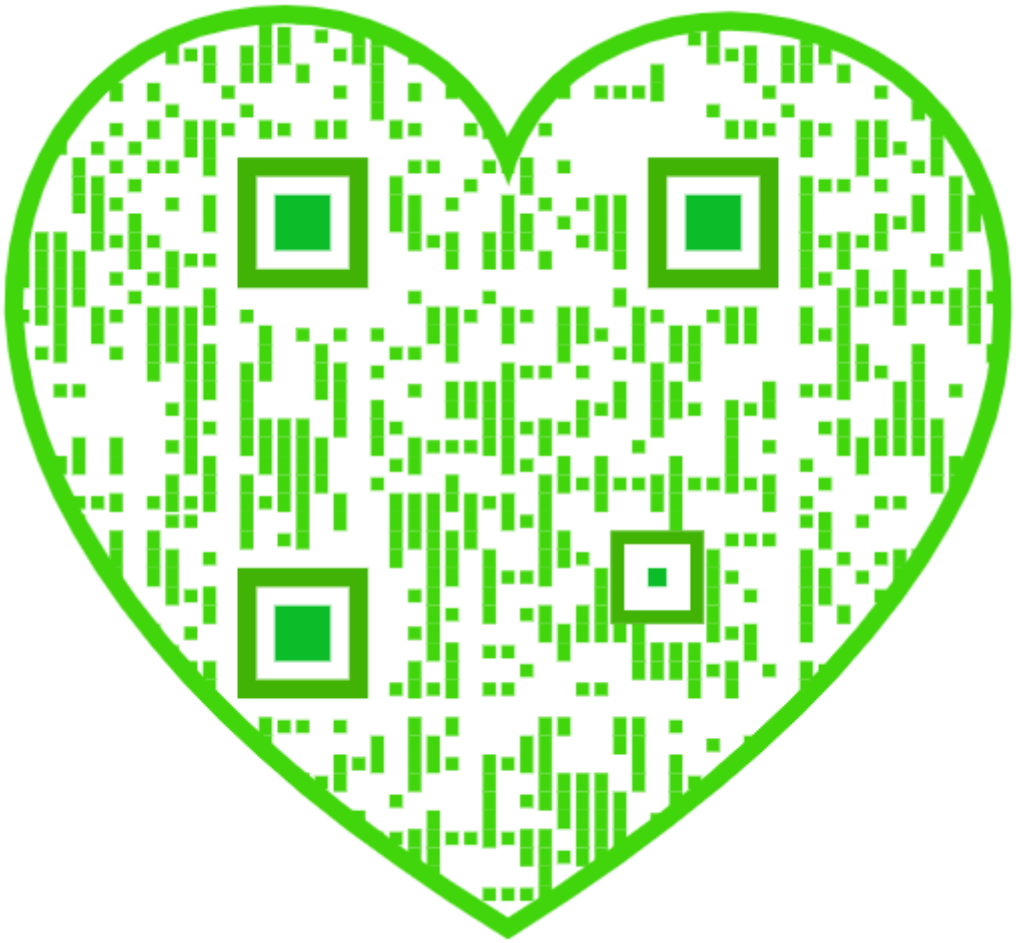

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NEW YORK, SATURDAY, AUGUST 28, 1897.

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THE RELATION OF THE BEET SUGAR FARM TO THE FACTORY.

In view of the widespread attention which is now certain to be given to the cultivation of the sugar beet, it is well to sound a note of warning with reference to one or two elementary facts, the neglect of which may bring much loss and disappointment to the well meaning but misguided husbandman. In the first place it must be remembered that there are many localities which are quite unsuited to sugar beet culture, and that these may occur within districts which are within the sugar belt, and are, generally speaking, well adapted to beet crops. It is therefore desirable that the farmer should make several tests in different parts of his farm before he commits himself to the hazard of a full crop. It will not be necessary to plant any considerable areas; small, detached patches will give him sufficient specimens to determine the value and quality of the crop. When it has been proved that his land is suitable, the next step is to ascertain the cost of delivering the beets to the nearest factory, and whether it is such as to allow beet farming to be carried on at a profit.

As there are only a few localities in the United States where beet sugar factories exist, it will be necessary to erect factories to receive and work up the crops, and it is in making the selection of sites that the greatest forethought and care must be exercised. The factory must be centrally located with regard to the beet-growing district, and at the same time it must, if possible, be situated upon a railroad or have connection through its own private side tracks. If the enterprise is to compete successfully with others, it should have the various materials of manufacture, such as limestone, fuel and water, within easy reach, and, of course, the nearer the factory is to the markets, the larger the net profits which will accrue to the farmer from his crop. It will be evident, from the recent description which we gave of the process of manufacture, that it requires a plentiful supply of water, fuel and limestone. If any or all of these have to be brought from a considerable distance, it can be seen that the profits of the undertaking will be seriously reduced. The necessity of rail connection is further evident when we bear in mind the large amount of residue in the shape of filtered cossettes. This is a valuable feed for cattle, and with reasonable transportation afforded it could be disposed of at profitable prices in the outlying country.

When it has been proved that the soil is suitable, that the materials of manufacture are near at hand, and that a market can be depended upon, any agricultural district may lay out its beet farms and build its own factory with a certain assurance that it will prove a profitable, and, what is better, a permanently profitable, investment both for capital and labor.

REPAIRS TO DRY DOCK NO. 3 AT THE BROOKLYN NAVY YARD.

Great interest attaches to the repairs which are being carried out on the new dry dock, known as No. 3, at the Brooklyn Navy Yard. Judged from the engineering standpoint, the problem is an entirely new one, and as there is no case just like it on record, the engineers will have to act entirely on their own initiative. For this reason the plans will, of course, be somewhat experimental and liable to modification as the work proceeds. In reply to our request for the detailed drawings of this work, the Assistant Secretary of the Navy, Mr. Theodore Roosevelt, informs us that the department does not wish to publish the drawings of the proposed work at the present stage, especially in view of the experimental nature of the work, as above referred to.

Dry dock No. 3, it will be remembered, is the one which subsequently to its opening developed a serious leak along one side near the entrance, which an examination by a diver showed to result from injury to the outside apron. The floor and sheet piling at the edge of the apron were found to be broken, and it was supposed that the dredge which was used in opening the entrance from the East River had struck the apron and injured it sufficiently to allow the entrance of water within the sheet piling. The depth of water (thirty feet) and the nature of the repairs rendered it impossible that the latter should be carried out under water, and accordingly the engineers are making provision for laying bare the bottom of the entrance for a distance of ninety feet back from the caisson gate. This will enable a thorough inspection to be made, not only of the broken apron but also of the side walls, back of the abutments, and of the various walls of wing piling which run out transversely to meet the great inclosing wall of sheet piling which encircles the whole dock. In carrying out this plan the engineers are building a massive cofferdam across the dock entrance, which will have sufficient strength to hold back the waters of the East River until the investigation and repairs are completed.

The cofferdam consists of three lines of heavy sheet piling, which extend in a curved form clear across the entrance from wall to wall. The inner wall will be about 90 feet from the caisson; 13 feet in front of this will be another wall, and 13 feet beyond this a third wall. The curve will, of course, be convex to the thrust of the water, to which it will present an arch effect, though not much reliance will be placed upon the latter in estimating the strength of the dam. The three walls will be strongly braced in the direction of the thrust of the water, and the whole interior space will be filled to above the water line with carefully rammed puddled clay.

The dam will possess considerable strength on account of its arched form and the interior trussing, and it will be further reinforced and rendered watertight by two embankments of clay and gravel, which will start at the water line and slope away to the bed of the river on the river side of the entrance, and on the inner side will finish against a fourth wall of sheet piling, which will be driven across the entrance about 30 feet from the toe of the apron. In making a junction with the sides of the entrance it has been necessary to cut into the concrete walls (which are carried upon piling), so as to allow the sheet piling of the cofferdam to be driven up to a snug connection with the sheet piling of the entrance.

From the above general description, it will be seen that in cross section the proposed cofferdam is not unlike the familiar earth dam used in reservoir construction. When it is completed and the water has been pumped out of the dock, a full examination can be made of the origin and extent of the leak.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

BY MARCUS BENJAMIN, PH.D.

The forty-sixth meeting of the American Association for the Advancement of Science was held in Detroit, Mich., during the week beginning with August 9. The sessions were held in the beautiful building of the Central High School, which occupies an entire square, facing Cass Avenue, between Hancock and Warren Avenues, and it is safe to say that at no recent meeting of the association have any such commodious and delightful quarters been assigned to it. The first general session was convened at 10 o'clock in the morning of August 9, in the auditorium of the high school, when the association was called to order by Secretary Putnam, who presented Dr. Theodore Gill, the senior vice-president, who had succeeded to the presidency in consequence of the death of Prof. Cope. Dr. Gill declared the meeting opened and introduced Mr. W J McGee, who, as senior vice-president, would occupy the chair, on account of the inability of Dr. Wolcott Gibbs to be present. An invocation was made by the Rev. Frank J. Van Antwerp, and appropriate addresses of welcome were made by the Hon. William C. Maybury, Mayor of Detroit, and the Hon. Thomas W. Palmer, former United States Senator from Michigan, who aptly defined science as "the classification of phenomena to the end that principles may be established and declared, from which may be deduced rules of action that shall be applicable to particular cases."

To these words of welcome Mr. McGee made a pleasing rejoinder, after which formal announcements of important matters were presented by the permanent secretary and the local secretary. The general session then adjourned and the sections assembled for organization. This effected, the members separated for luncheon, but later in the afternoon gathered again to hear the vice-presidential addresses.

The presiding officer of the section on mathematics and astronomy was Prof. Wooster W. Beman, of the University of Michigan, Ann Arbor, who spoke on "A Chapter in the History of Mathematics." This address was a sketch of the development of the geometric treatment of the imaginary, particularly in the latter part of the eighteenth and the first part of the nineteenth centuries. The speaker referred, in opening, to the fact that the square root of a negative quantity appeared for the first time in the Stereometria of Heron of Alexandria, B. C. 100. From this date the development of the use of the square root applied to a negative number was briefly traced through several centuries, accompanied by quotations and arguments from the various writers who attempted the problem.

Section B, on physics, was ably presided over by Prof. Carl Barus, of Brown University, Providence, R. I., whose address was on "Long Range Temperature and Pressure Variables in Physics." The first part of his address contained a history of the various attempts to provide suitable apparatus for high temperature measurement. He then considered the applications of pyrometry, referring at great length to the variation of metallic ebullition with pressure. Results already attained show an effect of pressure regularly more marked as the normal boiling point is higher. Igneous fusion was considered in its relation to pressure and with regard to the solidity of the earth. The question of heat conduction was taken up, and the results deduced by various writers as to the age of the earth discussed. High pressure measurement was dealt with. Passing from this subject, the entropy of liquids was considered. This subject of the heat produced by sudden compression of liquids is in its infancy, and only a year ago were any results of a satisfactory nature obtained. The paper ended with a reference to isothermals and several kindred subjects, all of them slightly dwelt on.

The section on chemistry was presided over by Prof.

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William P. Mason, of the Rensselaer Polytechnic Institute, of Troy, N. Y. He spoke on "Expert Testimony." He covered the entire ground from the standpoint of practical experience, looking at the question both through the eyes of the lawyer and the expert, giving a compact syllabus, pointing out the province of the expert, reviewing errors that he might be subject to and suggesting the solution for numerous difficulties. His concluding remarks were: "The expert witness should be absolutely truthful, of course, that is assumed; but, beyond that, he should be clear and terse in his statements, homely and apt in his illustrations, incapable of being led beyond the field in which he is truly an expert, and as fearless of legitimate ignorance as he is fearful of illegitimate knowledge. Mounting the witness stand with these principles as his guide, he may be assured of stepping down again with credit to himself and to the profession he represents."

The subject of the address before the section on mechanical science and engineering was on "Applied Mechanics." Prof. John Galbraith, of Toronto, Canada, who presided over this section, said, in opening, that the subject of dynamics is too often treated as if it were a department of applied mathematics rather than of mechanical science. While it is necessary that the student of dynamics know something of mathematics, it is unnecessary that he should be an expert in refined mathematical analysis, but he should possess, in some degree, the mechanical instinct. The history of dynamics, from the day when the experiments were carried on with but the rudest machinery down to the present day, was touched on and the experiments employed described.

In conclusion he said: "The science of dynamics, as it is understood at the present day, includes among its fundamental principles, in addition to the law of motion, the principle of the equivalence of work and energy and the principle of the conservation of energy; energy being measured, however, only in terms of force and displacement, or momentum and velocity. The only actions known in dynamics are force and its integrals, impulse and work. To identify with these all the other actions involving the transfer and transformation of energy, such as the conduction of heat, chemical reactions, induction of electric currents, etc., forms to-day the severest task of mathematical physics."

Section E, on geology and geography, was to have been presided over by Prof. Israel C. White, of the University of West Virginia, but, owing to his attendance on the International Geological Congress, held this summer in St. Petersburg, he was not present, and Prof. E. W. Claypole was named by the council to fill his place. Prof. White's address was on "The Pittsburg Coal Bed," but it was not read at the time appointed, owing to some difficulty in regard to the receipt of the manuscript.

Dr. Leland O. Howard, of the Department of Agriculture, Washington, D. C., presided over the section on zoology, having been appointed to that place by the council at its meeting in the spring, when the death of Dr. G. Brown Goode was made known to that body. The subject of Dr. Howard's address was "The Spread of Species, by the Agency of Man, with Special Reference to Insects." He showed that natural spread was for centuries the rule, but that with the improvement of commercial intercourse between nations the agency of man has become predominating. He spoke of the intentional introduction of useful plants from foreign countries and of the occasional introduction of flowering species which escaped from cultivation and became weeds. The intentional introduction of wild animals has generally been disastrous. He instanced the introduction of the English sparrow, of the Indian mongoose into Jamaica, of the flying foxes from Australia into California, of the gypsy moth from Europe into North America. Accidental introductions have been more powerful in extending the range of species and in changing the character of the plants and animals of given regions than intentional introductions. The era of accidental importations began with the beginning of commerce and has grown with the growth of commerce. The vast extensions of international trade of recent years, every improvement in rapidity of travel and in safety of carriage of goods of all kinds have increased the opportunities of accidental introductions, until at the present time there is hardly a civilized country which has not firmly established and flourishing within its territory hundreds of species of animals and plants of foreign origin, the time and means of introduction of many of which cannot be exactly traced, while of others even the original home cannot be ascertained, so widespread has their distribution become.

Mr. W J McGee, of the Bureau of Ethnology, was the presiding officer of the section on anthropology. He spoke on "The Science of Humanity." Taking up the domain of anthropology, he showed that the study of man began with wounds and diseases, and grew into surgery and medicine. Then were developed physiology, pathology, etc.—sciences relating to the human body, which may be combined under the term somatology; then ethnology, the science of races and peoples, and finally psychology. All of these sciences relate to man considered as an organism, to his animal side. But there are other branches dealing with man as a sentient, volitient and intelligent being, such as esthetology, the science of the activities of mankind which are of a pleasurable character; technology, the study of the occupations and industries of man; sociology, which deals with the relations of men to men collectively; philology, the science of language and literature and of all human expression; sophiology, or the science of the essentially intellectual activities which form the motive and burden of expression, and their products comprise beliefs, opinions, knowledge, wisdom.

Arguing in this manner, he urged a closer study of the different branches of anthropology and claimed that in the near future its established subdivisions would be universal, thus affording an increasing knowledge of humanity.

The section on botany was presided over by Prof. George F. Atkins, of Cornell University, Ithaca, N. Y. His address was on "Experimental Morphology." It was highly technical, and treated of certain special phases of morphology. Indeed, it was rather devoted to a summary of experimental morphology as applied to the interpretation of the modes of progress followed by organs in attaining their morphologic individuality, in the tracing of homologies in the relation of members associated by antagonistic or correlative forces, the dependence of diversity of function in homologous members in external and internal forces, as well as the course which determines the character of certain paternal or maternal structures. His treatment of the subject was by the citing of numerous illustrations gathered from recent botanical literature.

One of the most interesting addresses was by Richard T. Colburn, vice president of the section on social and economic science, who spoke on "Improvident Civilization." He described at great length the history and devastating effects of war, and also such subjects as pernicious competition, spendthrift luxury, the blight of parasitism, and the role of superstition. The effect of improvident civilization on humanity was illustrated by the following description of the coming man. He said: "The coming man will be a big-headed, small-bodied, puny-limbed, bald, toothless, spectacled, and toeless creature subsisting on concentrated foods. The fate of that people where teeth and eyes decay and dentists and opticians flourish is not at all conjectural, It concerns the student of physiology and sociology alike to ascertain what causes are at work impairing the digestive organs, the teeth and eyes of civilized peoples, and in what respects the as yet uncivilized have a manifest advantage."

This completes the addresses delivered by the vice-presidents, and they served as it were to whet the appetite of the hungry scientists for the presidential address that followed in the evening.

No naturalist of modern time has achieved a greater reputation than Edward D. Cope, and it was fortunate for the association that Cope's fellow student and close friend during his scientific career should have been the senior vice-president on this occasion. It was eminently fitting, therefore, that Dr. Gill should present as a retiring address a memorial sketch of his friend. This address is being published in full in our SUPPLEMENT, but space must be found for two paragraphs.

"Prof. Cope," said Gill, "was one of the greatest naturalists our country has ever brought forth. From his early years he was an ardent devotee to the science of zoology and kindred branches. When but twenty years of age he prepared and published material on this subject which might well be worthy of a man of more mature years." Passing over the history of his life with its more than ordinary struggles and vicissitudes, together with an analytical account of his many contributions to his chosen work, Dr. Gill closed with the following:

"Prof. Cope found his life's study an art and left it a science.

"The subject which was to him the most interesting was the study of evolution and the origin of species. He was not satisfied with Darwin's theories. He believed that the peculiar habits of an animal, influenced by environments or conditions, would make felt its effect in future progeny. His ideas were original, but perhaps not entirely logical. For instance, he believed that the human arms were not developed in accordance with the growth of the skull. I believe that in reality he should have said that the lower limbs were lengthened. This is proved by comparison with the form of a child.

"He certainly was a man as wonderful as Huxley and Cuvier."

Dr. Gill's address was followed by the reception given to the members of the association by the citizens of Detroit.

During the days that followed much good work was done by the individual sections, and any attempt to select for mention papers that were read is practically impossible. It is sufficient to say that, owing to the presence of a large number of chemists and geologists, on account of the simultaneous meeting of the American Chemical Society and the Geological Society of America, the mention of papers before the sections on chemistry and geology was large and they were of more than common interest and value. The presence, also, of a number of foreign scientists who came to attend the meeting this week in Toronto of the British Association gave an additional distinction to the Detroit meeting.

Two joint sessions deserve a word. On Wednesday afternoon the section on geology met with that on anthropology, when papers were read discussing the possibility of the existence of preglacial man. The recent excavations in the Trenton gravel, accompanied by certain finds, had led the anthropologists to believe that possibly man could have existed in America prior to the glacial period. In several papers they presented their interpretations of their discoveries, but the geologists were unwilling to concede the assumptions claimed, and, although admitting that the geological horizon was not positively determined, still it could not be claimed as yet that evidences of preglacial man had been found in any geological formation that was beyond dispute of preglacial origin.

The other joint session was that of the sections on zoology and botany, before which Prof. Henry F. Osborn, of Columbia University, presented his paper on "Modifications and Variations and the Limits of Organic Selection," in which the present ideas of the Neo-Lamarckian school of the development theory were fully presented. Insomuch as this school flourishes most strongly in this country, its adherents had no difficulty in sustaining their grounds against their English confreres, who were represented by Prof. E. B. Poulton, of Oxford University.

It was admitted on all sides that, notwithstanding the comparatively small number of members of the association present at the Detroit meeting, the papers were of uncommon value, and, therefore, the meeting was a completely successful one.

Besides the usual minor excursions of the different sections to points of interest to botanists, geologists, chemists and others, the special excursion of the meeting, complimentary to the association by the citizens of Detroit, was made on Saturday, August 14, to Ste. Claire Flats. This trip enabled the members to view the character and extent of the river front of the city of Detroit, and also gave a comprehensive view of the magnitude of the shipping of the great lakes passing through this strait. This excursion carried the members of the association through the United States Ship Canal in Lake Ste. Claire Flats, and through the many islets which have been reclaimed from the shallows of that body of water.

The American Association came into existence in Boston, in 1848, and, in consequence, the scientific institutions and prominent citizens of that city extended to the association a hearty invitation to meet in Boston in 1898. This offer was accepted by the association, and it is proposed by the association to celebrate its fiftieth anniversary by a jubilee meeting, at which the addresses will take the forms of reviews of the progress of the sciences in America during the past fifty years; so that the memorial volume for 1898 will be the finest summary of American science in all its branches ever presented to the public. For this reason it is believed that the Boston jubilee meeting will be the greatest scientific gathering ever held in the history of the association.

The officers chosen for this meeting were: Prof. Frederic W. Putnam, of Harvard University, president.

Vice-presidents.—Mathematics and astronomy, Edward E. Barnard, Yerkes Observatory, University of Chicago, Chicago, Ill.; physics, Frank P. Whitman, Adelbert College, Cleveland, Ohio; chemistry, Edgar F. Smith, University of Pennsylvania, Philadelphia, Pa.; mechanical science and engineering, M. E. Cooley, University of Michigan, Ann Arbor, Mich.; geology and geography, H. L. Fairchild, Rochester University; zoology, A. S. Packard, Brown University, Providence, R. I.; botany, W. F. Farlow, Harvard University, Cambridge, Mass.; anthropology, J. McKeen Cattell, Columbia University, New York City; economic science and statistics, Archibald Blue, director of Bureau of Mines, Toronto, Canada.

Permanent secretary, L. O. Howard, Department of Agriculture, Washington, D. C.; general secretary, D. S. Kellicott, Ohio State University, Columbus, O.; secretary of the council, Frederick Bedell, Cornell University, Ithaca, N. Y.; treasurer, R. S. Woodward, Columbia University, New York City

Secretaries of the Sections.—Mathematics and astronomy, Alexander Ziwet, University of Michigan, Ann Arbor, Mich.; physics, E. B. Rosa, Wesleyan University; chemistry, Charles Baskerville, University of North Carolina, Chapel Hill, N. C.; mechanical science and engineering, William S. Aldrich, University of West Virginia, Morgantown, W. Va.; geology and geography, Warren Upham, St. Paul, Minn.; zoology, C. W. Stiles, Department of Agriculture, Washington, D. C.; botany, Erwin F. Smith, Department of Agriculture, Washington, D. C.; anthropology, M. H. Saville, American Museum of Natural History, New York City; economic science and statistics, Marcus Benjamin, U. S. National Museum, Washington, D. C.

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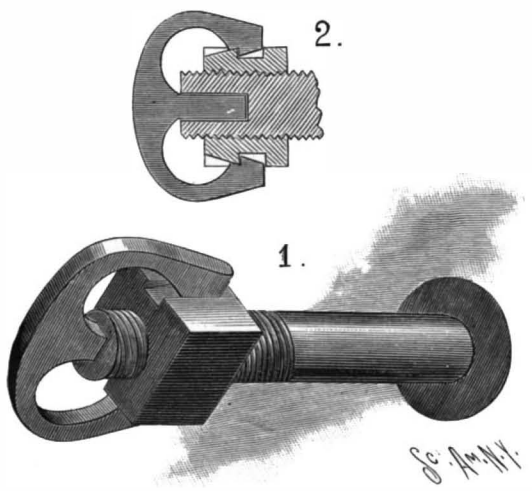
A SIMPLE NUT LOCK.

According to the improvement represented in the accompanying illustration, a yoke is adapted for convenient connection with the bolt and nut in such manner as to positively prevent both from turning. The improvement has been patented by John H. Hartman, and correspondence in relation thereto should be addressed to Frank Fisher, Germantown, N. Y. Fig. 1 shows the application of the lock, Fig. 2 being a view in section. In the threaded end of the bolt is a longitudinal recess of square or polygonal cross section, and in opposite sides of the outer face of the nut are inclined guideways connected with recesses of sufficient size to

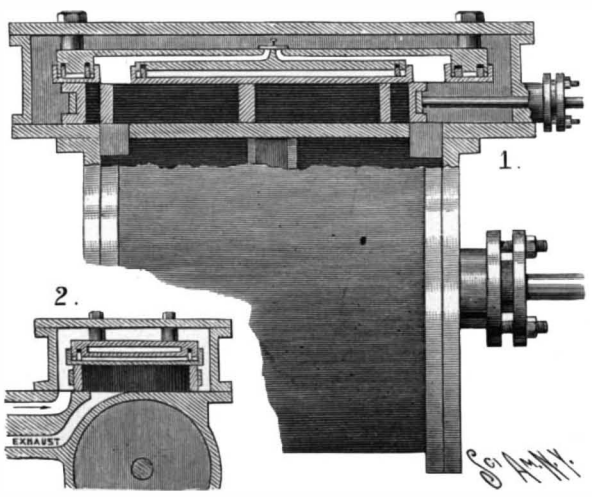


HARTMAN'S NUT LOCK.

just receive heads which form the two terminal portions of the yoke. The latter has a central tongue, of cross sectional shape corresponding to the recess in the end of the bolt, and when the tongue is entered in the recess, and the yoke is pushed forward in the guideways of the nut, both bolt and nut are locked so that the nut cannot turn on the bolt or the bolt turn in the nut.

AN IMPROVED BALANCED SLIDE VALVE.

The accompanying illustration represents a valve of simple and durable construction designed to permit a quick admission and exit of the steam to and from the cylinder, at the same time facilitating a quick exhaust. It has been patented by Isaac C. Griffith, of Vicksburg, Miss. Fig. 1 represents a sectional side elevation of the improvement, and Fig. 2 shows a transverse section. On the top of the slide valve, adapted to open and close the ports at the ends of the cyllnder, rests a face plate forming part of a balance plate supported by bolts or other suitable means from the cover of the steam chest, there being between the two plates a suitable packing to prevent leakage of steam, and the packing being so placed as not to be in contact with a rubbing surface. The slide valve ports register at their upper ends with relief ports in the face plate leading to channels in the balance plate, there being over the inner ends of such channels a valve or button adapted to open these channels to the steam chest when back pressure comes from the cylinder. The sides of the relief ports fit into channels in the under side of the balance plate, where a packing is arranged around the sides and ends of the ports, the ar-



GRIFFITH'S BALANCED SLIDE VALVE.

rangement being such that the slide valve is in contact at its top surface with the under side of the face plate and not with the packings interposed between the face plate and the balance plate. The packing is preferably of an indestructible and expansive material, such as asbestos, and gives sufficiently to firmly hold the face plate at all times in frictional contact with the slide valve, and a metal flange may be made integral with the face plate, fitting in recesses in the balance plate, in which is the asbestos. The steam when compressed in the cylinder to more than boiler pressure will readily flow back into the steam chest, the steam then lifting the valve or button in the balance plate, and all danger of blowing off the steam chest or cylinder heads being thus prevented, while the slide valve is so equally balanced that the only force necessary to operate it is that required to move the weight of the valve, and overcome the slight friction caused by its weight and the pressure of the face plate on top of it.

Old Age Pensions in Germany.

An English Foreign Office paper just issued contains a report on the insurance in Germany against accidents and in case of old age and infirmity. The accident business is in the hands of trade associations, government insurance establishments, and insurance establishments of 13 building trade associations. The 112 trade associations are divided into 64 industrial and 48 agricultural, and the number of persons insured in 1895 was 17,698,633, subdivided thus: Industry, 5,409,218; agriculture, 12,289,415. Fishermen, domestic servants, and all persons carrying on small industries alone or employing a few apprentices are excluded from the operation of the act. The government insurance establishments insure government employes in the naval, military, postal, railway, transport, forest, and building services, to the number of 690,835.

The year 1895 was the fifth since the institution of the new system of old age and infirmity insurance. The total sums paid were £419,000 to the infirm and £781,500 on account of old age. The total expenditure was about £1,866,000. The receipts from subscriptions from laborers, rent, etc., amounted to £5,337,000. The accumulated fund was thus raised to £19,038,000. The expenses of administration were about five per cent of the total receipts. The increase in periodical subscriptions shows how popular the system is becoming.

The average weekly subscription per person subscribing amounted to about 2½d. The average old age pension was £3 13s. per annum, and of an infirmity pension £3 3s., without counting the subsidy from the state of £2 10s. The sum above mentioned, £19,038,000, bore interest in 1895 at the rate of 3·58 per cent against 3·67 per cent in 1891. The disbursements of the empire under the act of 1889 were in 1895–96 £846,659, and the amount allowed in the budget was £765,625. The amount allowed in the estimates for 1897–98 is £1,065,000. In July, 1896, the number of pensions was 341,973. According to the estimates of 1897–98, the number of pensions which lapse is about 11 per cent of the total number, inclusive of the new pensions granted in the year, the number of which is estimated at about 84,000.

Disease Germs in Soils.

It has been observed in France that, in localities where animals are interred which have died of charbon, the germs of this infectious malady persist in the soils for many years, and that, especially when cereal crops are cultivated upon such soils, there is great danger of contaminating healthy cattle with the same disease. In one case it was observed that many sheep which were pastured in a field in which, two years before, a single animal which had died of charbon was buried were infected with the disease and died. In like manner, it is entirely probable that the germs of hog cholera may be preserved in the soil for many years, to finally again be brought into an activity which may prove most disastrous for the owners of swine. Every effort should be made by agronomists to avoid infecting the soil by carcasses which are dead from any zymotic disease.

Cremation is the only safe method of disposing of such infected carcasses. The investigations of scientists have shown that there are many diseases of an infectious nature due to these germs, and that these germs may preserve their vitality in the soil. Among others may be mentioned yellow fever and tetanus, and the microbe producing the bubonic plague, which retains its vitality in the soil, and thus escapes entire eradication.

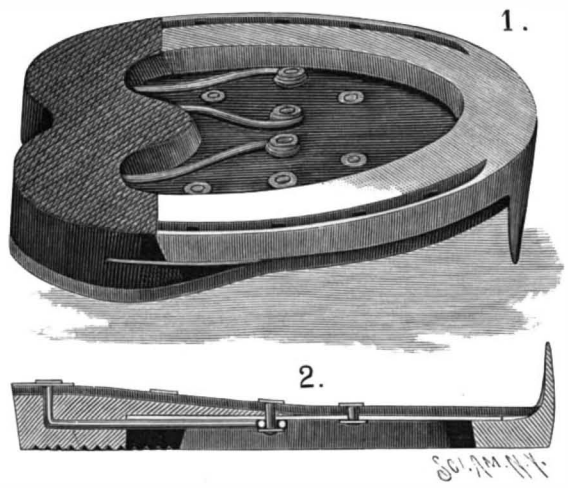
For the reasons given above, the agronomist, who also has at heart the health and welfare of man and beast, can hardly look with favor upon any of the plans which have been proposed for the use of sewage from large cities for irrigation purposes. There is scarcely a time in any large city when some infectious disease due to the activity of germs does not exist, and the sewage is liable at all times to be contaminated therewith.—H. W. Wiley, in Jour. Frank. Inst.

"Perpetual Motion."

In this week's issue of the SCIENTIFIC AMERICAN SUPPLEMENT we commence the publication of a series of articles under the above title which were originally published in the SCIENTIFIC AMERICAN in the latter part of 1870 and early in 1871. The articles are fully illustrated and many of the devices described are extremely curious, while some of the quaint ideas advanced by early investigators, although they may frequently evoke a smile, may yet find a parallel in schemes not infrequently brought forward at the present day. The publication will be continued through several numbers of the SUPPLEMENT, and will doubtless prove especially interesting to many inventors.

AN IMPROVED HORSESHOE PAD.

The illustration represents a pad which extends over the entire bottom of the foot, and which is especially designed to ease the heel of the horse, preventing also slipping on smooth roads, the balling of snow under the foot, and injury to the foot by sharp objects. The improvement has been patented by Horace W. Billington, of No. 565 Jersey Avenue, Jersey City, N. J. Fig. 1 is a bottom view of the pad with shoe attached and Fig. 2 represents a central lengthwise section. A

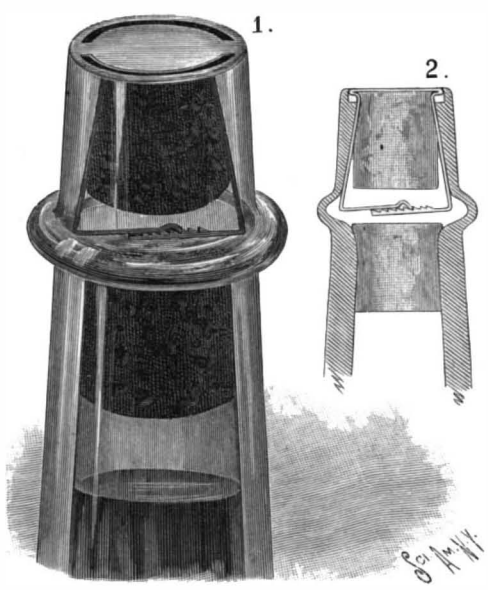


BILLINGTON'S HORSESHOE PAD.

sole, preferably of leather, is shaped to cover the entire foot, and on the heel section of the sole is secured a cushion bearing block, over a forward extension of which is a protection plate, preferably of metal, the plate being secured to the sole and cushion block by rivets. A tie plate is located on the upper face of the sole at each side of its center, and these plates serve as anchorages for tie rods carried forward through the body of the cushion bearing block, and terminating in eyes through which are passed rivets, which also assist in connecting the cushion block, protection plate, and sole. The shoe used with this pad is shorter than the ordinary shoe, and its toe extends upward beyond the sole, a portion of which is cut away for such purpose, the shoe being nailed to the foot in the ordinary way, and the nails also serving to hold the several parts of the pad, together with the shoe, firmly on the foot.

A NON-REFILLABLE BOTTLE.

A bottle which may not a second time be used or disposed of as an original package, after having once been opened, is represented in the accompanying illustration, and has been patented by Charles R. Gibson, of Woodsville, N. H. Fig. 1 shows in perspective the neck of a bottle having the improvement, Fig. 2 being a sectional view. The neck is made with an outwardly bowed section forming an exterior rib of quite thin glass, permitting the portion above to be readily broken off at this point. Above the rib the inner wall of the neck is beveled, and at the mouth is a flange forming a recess in which is seated the cap of a locking yoke of spring material, the opposite foot sections of the yoke having, respect-



GIBSON'S NON-REFILLABLE BOTTLE.

ively, a pawl and ratchet. The bottle having been filled, a cork is placed in its neck below the frangible rib, and a second cork, fitted in the top of the locking yoke, is forced downward into the upper section of the neck of the bottle, when the side members of the yoke expand, and, by their pawl and ratchet engagement, prevent the removal of the yoke and its cork except by breaking off the upper portion of the neck. In seating the locking yoke with its cork in the neck of the bottle, a rubber gasket is preferably placed in the flange or recess between the cap of the yoke and the top of the neck of the bottle.

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HAYWARD AUGUSTUS HARVEY.

Hayward Augustus Harvey was born at Jamestown, N. Y., January 17, 1824.

He was the son of Gen. Thomas W. Harvey and Melinda Hayward, who had moved from Wardsboro, Vt., to Jamestown in 1814.

The line runs back through Rufus, Jonathan, William and Thomas to William Harvey, the emigrant, who was one of the early settlers in the Massachusetts Bay colony.

The father of the subject of our sketch was a skilled mechanic, who went to Jamestown under contract to set up the machinery for a cotton factory. This enterprise fell through, and he remained as the village blacksmith.

"The smith, a mighty man was he," indeed, for he measured 6 feet 3 inches in his stockings, and weighed 280 pounds. During the time he lived in Jamestown he, with his brother Charles, built most of the machinery used in the factories that were started in that enterprising town.

Gen. Harvey was a brigadier-general in the New York militia, and he was an inventor of great fecundity. His inventions include many mechanisms now in general use. He was pioneer in automatic pin machinery and screw machinery, into which he introduced the toggle joint and the cam movement. He was the inventor of the gimlet pointed screw. He was, perhaps, the first to depart from the old blister or cement process and to introduce the manufacture of crucible steel.

In 1842 he ran all the machinery in his machine shop by a magneto-electric engine. As early as 1841 he remarked to the late Dr. Hazeltine, at that time an inmate of his family: "If you live to the ordinary age of man, you will see electricity the great motor power of the world."

He was one of the founders and at one time president of the American Institute.

In 1833 he moved to Ramapo, and in 1836 to Poughkeepsie. His family moved with him, and here his son Hayward was educated, attending school in the academy, and later in the academy at New Paltz, N. Y. From this school he went to his father's factory, at Poughkeepsie, where he learned draughting and various branches of mechanical engineering.

The Poughkeepsie Screw Manufacturing Company was organized in 1836. Gen. Harvey was one of the incorporators, and the plant was based upon his inventions. These were patented in 1846. The product was the gimlet pointed screw.

In 1844 the New York Screw Company was organized, with Gen. Harvey as president. Hayward A. Harvey was appointed the draughtsman. The English patent officials of that day pronounced his drawings to be the best that they had received from America.

In 1849 the Somerville, N. J., company was reorganized as the Union Screw Company, and young Harvey took charge of the wire mill. In 1851 he went into the wire business in New York, but was burned out within a year. In 1852 he entered the Harvey Steel and Iron Company, of which his father was president, and whose works were established at Mott Haven. They also had a small company at Canaan, Conn., called the Wangum Iron Company, which was devoted largely to experimental studies in the metallurgy of iron and steel.

The death of Gen. Harvey, in 1854, turned Hayward's attention from the study of these subjects, and he devoted himself for the next thirty years to inventing and improving automatic machinery. During these years he was at times closely connected with the American Screw Company, of Providence.

His first invention was the corrugated blind staple, which was invented when he was eighteen years old and is in universal use at the present time.

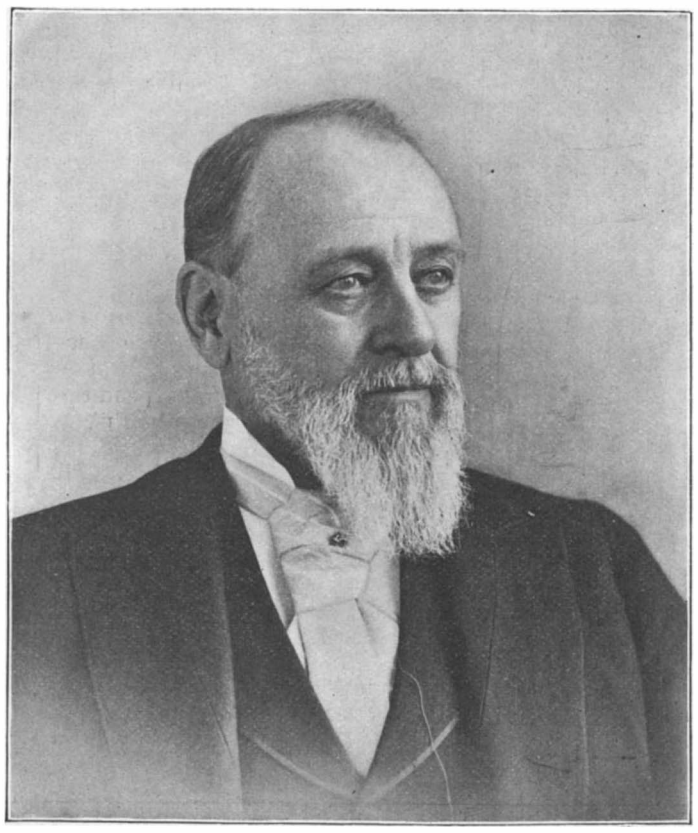
In 1865 he founded the Continental Screw Company, of Jersey City, which became the owner of his first patents on screw machinery, covering the entire process of wood screw making. This company after a short time was bought out by the American Screw Company.

From 1870 to 1890 he was constantly at work designing new machinery for making screws, bolts, wire nails, washers, spiral springs, and many similar articles.

In 1875 the Harvey Manufacturing Company was formed with Mr. Harvey's new track bolts as its product. In his first bolt, the thread on the bolt was formed with a varying pitch, and the thread of the nut with a uniform pitch, or vice versa. The nut is locked by the upsetting of the threads. There were several varieties of these bolts. They were favorably received by the railroads and are widely used. The Kansas City Bolt and Nut Company now make bolts of Mr. Harvey's invention.

In 1881 the Harvey Screw Company was formed to manufacture and sell the product of the "rolled screw" machinery, which was the most notable of his inventions during this period. Instead of the thread being cut into the wire, it was partly rolled into and partly pressed out from the surface of the blank by a cold forging process. These screws have a sharp central point, which, with the large thread and the small neck, make the entrance into the wood easy. This company was later merged into the Harvey Screw and Bolt Company.

One variety of these screws had two knobs on the surface of the head instead of a nick. The ordinary tapering screw and the gimlet pointed screw were also made on these machines. These inventions revolutionized the art of screw making and about 1886 became the property of the American Screw Company, of Providence, and of the Nettlefolds, of England.

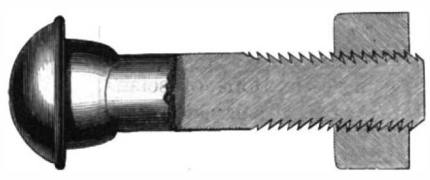


HAYWARD AUGUSTUS HARVEY.

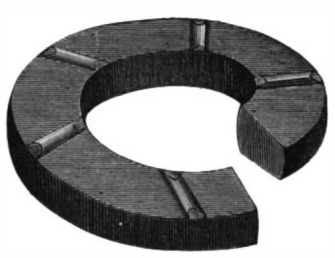
Notwithstanding the efficiency of the "grip" bolt, many engineers demanded a washer or nut lock. To meet this demand Mr. Harvey invented the "ribbed spiral" washer, which was manufactured by the National Lock Washer Company. Within six months after formation this company was paying substantial dividends, and has remained a handsomely paying property up to the present time.

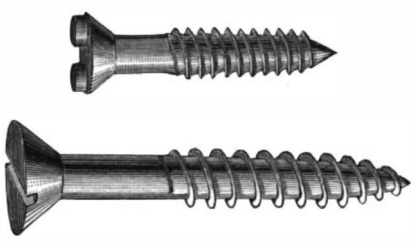
In 1891 the American Washer and Manufacturing Company was formed to manufacture other products of his inventive skill, viz., washers and spikes, but they have confined their attention to the "Harvey ribbed" and the "coil" washers.

These washers have been widely adopted by many railroads and in many comparative tests have always been found among the best.

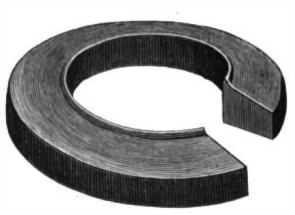


BOLT WITH VARYING PITCH.





COLD ROLLED SCREWS.



SPRING WASHERS.

While experimenting with bolts and nuts, Mr. Harvey conceived the idea of making a bolt and nut of cast iron, with threads partially impressed on them in the mould, and then of hardening or "steelifying" the surface of the threads of the bolts and nuts so as to give them the necessary hardness.

The experiment was a failure, but the character of the product indicated that he had made a discovery in the metallurgy of steel. Experiments following this indication resulted in the production, from low grade Bessemer steel, of steel capable of taking the finest temper. In 1888 patents on this new product and process were granted to Mr. Harvey, and works were established in Jersey City, afterward moved to Newark.

Later studies and experiments by Mr. Harvey led to the world-famous invention of the Harvey armor plate product and process. It is interesting as an historical fact that in 1891 the armor makers of England and the Continent had for a generation been trying to keep pace with the improvements in the projectile, and had fallen farther and farther behind, and that in America armor had not been made, although expensive plants had been erected for that purpose; yet on the very proving grounds where the armor plates of various foreign armor makers were being tested to determine which should be used for the new American navy, a small piece of steel armor lay unnoticed which was to revolutionize the whole art of armor plate making.

This plate had been treated by Mr. Harvey at Newark, on ideas of his own, and was tested at Annapolis a few days previous to the competitive test.

A few weeks later a full sized plate was tested, and the United States adopted it as the type of armor for the new ships. The European governments soon followed, and to-day Harveyized armor plate is the recognized standard of the world.

An intimate business friend has written of him as follows: Mr. Harvey lived long enough to see the fruits of his labors and to participate in the profits. He was emphatically a progressive man. When his mind was engaged in inventions, it was difficult for him to stop; he always saw so much beyond. His processes of thought were entirely original. In making his inventions he usually declined to be guided by the experience of others. The fact that some one had done a certain thing in a certain way almost always made him reject that way and look for a path of his own. He was a singularly persuasive man, as he must needs be to get the attention and the confidence and support of prominent capitalists, in which he was very successful. Although always a positive man, yet it is doubtful whether he left any enemies behind him, on account of his sympathetic and really lovable nature, which made warm friends for him among all classes of men.

Mr. Harvey died at his home in Orange, N. J., on August 28, 1893. At the time of his death he was president of the Harvey Steel Company and vice-president of the American Washer and Manufacturing Company.

The history of screw making in America would be very meager if we should leave out the work of the Harveys—father and son. Their ideas were always original and far reaching in their influence, and it is doubtful whether anywhere screws are made without taking advantage of principles discovered and developed by them.

Similarly in the metallurgy of steel their influence has been important. The elder Harvey was a careful and brilliant experimenter. His son was trained by him, and the great achievements of the younger Harvey are the crowning results of many years of experimentation and thought.

Mr. Harvey took out seventy-nine patents, nearly all in the lines indicated above.

Coal from China.

It is rather startling to find that coal can be mined in China and sold in California at a profit, says Locomotive Engineering. Several cargoes of coal from China have been imported into California, and it is reported to be of very good quality.

Those who are familiar with the coal market say that within a very few years the Chinese coal mines will supply the whole market of the Pacific coast, except those portions where coal is found. The extremely cheap labor of China enables the coal to be brought to the surface at a very low price. The only obstacle to very active competition in this industry at present is the want of good transportation facilities in China. The extension of Chinese railways, which has begun very actively, is going to exert a very prejudicial effect on the coal mining interests of the United States and Great Britain.

ACCORDING to the New York Evening Post, George A. Brill, of Poughquag, Dutchess County, who was graduated from Cornell University in 1888, recently received a cable dispatch from Li Hung Chang offering him a liberal sum to organize and manage a model farm in China under the government. He will accept the offer and will soon leave for China to enter upon his duties.

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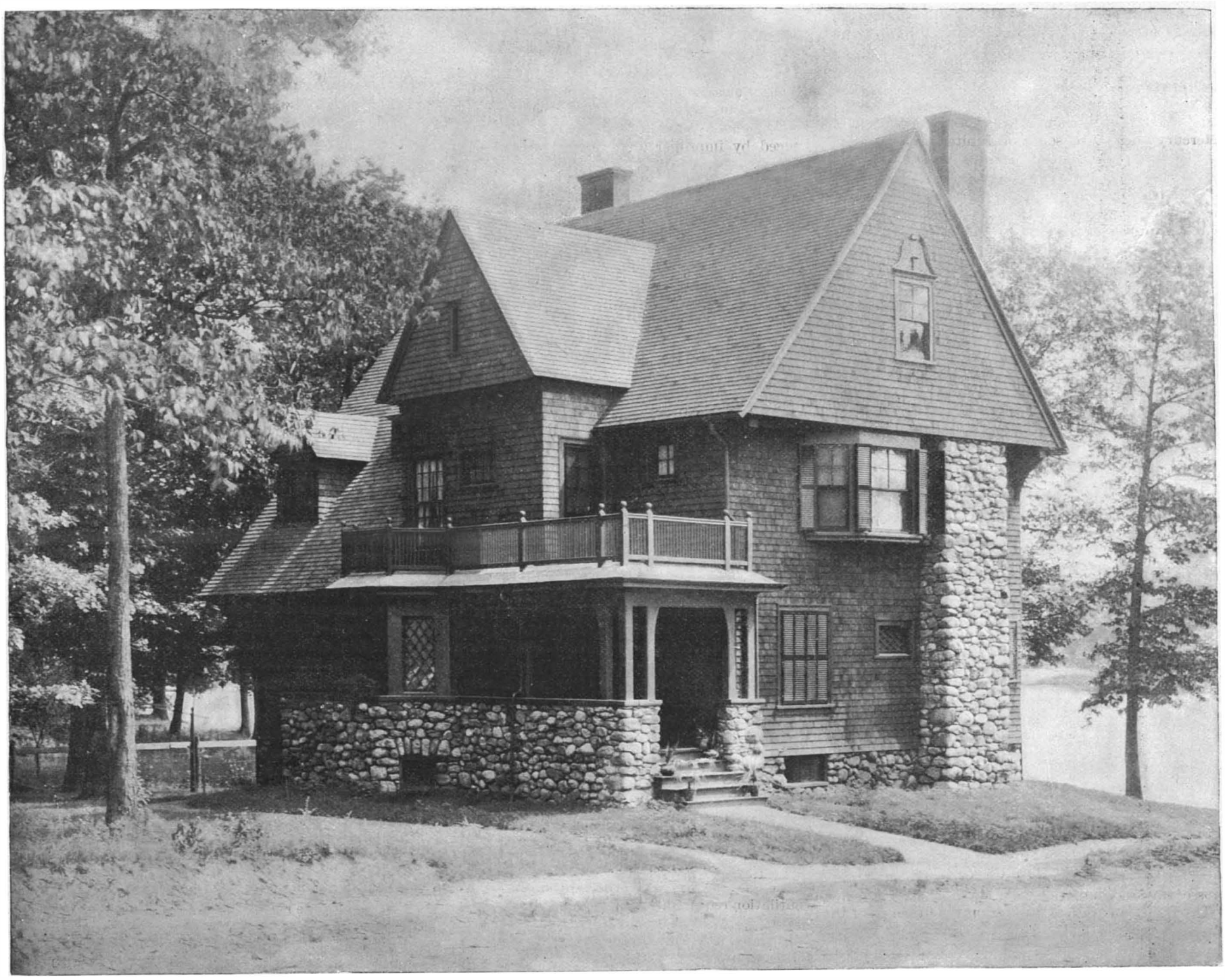
A SUBURBAN COTTAGE AT BOSTON, MASS.

Our engraving shows a model suburban cottage which has been erected recently for Mr. William B. Merrill, at Newton Center, Boston, Mass. The site is an attractive one, at the side of Newton Lake, and this adds much beauty to the already picturesque design, which is well ornamented by a pleasant porch on either side of house, and a chimney which is a feature in itself. The chimney, balustrade at porches, and underpinning, are built of field stone laid up at random in a neat manner. The exterior framework above is covered with sheathing paper, and then shingles, and stained a mahogany color. The trimmings and blinds are painted bottle green. Roof shingled. Dimensions: Front, 45 feet; side, 44 feet, exclusive of porches. Height of ceilings: Cellar, 8 feet; first story, 9 feet; second, 9 feet; third, 8 feet. The entrance is through a paneled lobby 5 feet square. The main hall is trimmed with oak. It has a paneled wainscoting, columns between reception room, rising to ceiling, and forming an arcaded effect, and an ornamental staircase with a broad landing, and bay window thrown out, giving ample light and ventilation.

The reception room is treated with china white, dead finish, and in a dainty manner. The library is trimmed with oak, and it contains an octagonal projection thrown out, and a pleasing nook with seats, and an open fireplace trimmed with tiled hearth and facings, and hardwood mantel with columns and mirror. The dining room is trimmed and finished similar to library. Kitchen and pantries are trimmed and wainscoted with whitewood, and are furnished with the usual necessary fixtures complete. The second floor is trimmed with whitewood, and it contains four bedrooms, large closets, and two bathrooms. The bathrooms are treated with white enamel, and are fitted up with porcelain fixtures and exposed nickelplated plumbing. The third floor contains billiard room, one bedroom, and trunkroom. Cemented cellar contains furnace, laundry, and other necessary apartments. Mr. Bertrand E. Taylor, of the firm of Rand & Taylor, Kendall & Stevens, 87 Milk Street, Boston, Mass., architect.

Our engravings were made direct from a photograph of the building, taken specially for the BUILDING EDITION SCIENTIFIC AMERICAN.



A SUBURBAN COTTAGE AT BOSTON, MASS

Severe Test for Some Watches.

At the two great centers of the English watch trade, Coventry and Birmingham, the standard quality of workmanship is still considered, after so many decades, the perfection of artistic skill attainable in this line. Singular enough, while the test of excellence in a watch is that it obtain a Kew certificate, it is stated that of the watches that go to Kew 75 per cent are from Coventry; and while at Kew no watch has yet succeeded in obtaining the 100 marks which signify perfection, Coventry has come nearest, with 92, and well maintains this reputation. That this Kew test is no light one will be understood from the statement that the watch is tested in every position and its rate registered, not only per day, but per hour. It is hung up by its pendant, hung upside down, hung on each side, placed dial down and back down, and, finally, is baked in an oven and frozen in an ice pail. When, therefore, it is considered, says the Jewelers' Review, that it makes eighteen thousand vibrations an hour and must not vary a second a week, while a quarter turn of its two time screws—meaning a millionth of an inch—will make a difference of twenty seconds a day, the delicacy of its adjustment will be appreciated, as also the risk of intrusting its repair to any but skillful hands.

The Proper Care of Umbrellas.

Judge Dustin, in speaking of his stay in England, said: "Umbrellas are carried every day, for showers there are liable to occur at any moment."

It seems, therefore, that we cannot do better than follow the directions of an Englishman on the proper care to take of an umbrella:

Do not let it dry while opened, as this strains the silk and makes holes at the seams.

Do not place it to dry with the handle up. In this case the moisture lodges in the center, where the ribs meet, causing the silk to decay.

Never put it in the wardrobe without unrolling it, or after a long period of dry weather you may have the misfortune of finding that the continuance of the pressure has cut the silk between each rib.

If you are satisfied for the present with your umbrella, and are not anxious to be obliged to purchase a new one, see that it drips on end with the handle down, unless the handle is valuable and easily injured by damp. Such an umbrella cannot be cared for according to any fixed rules.

How Mineral Waters Cure.

When a patient reaches a mineral water health resort, he is examined by the resident physician and ordered to drink certain quantities of the water at certain times during the day; this is increased from day to day until the maximum quantity needed is reached. He is ordered to drink one or two glassfuls upon rising, two or three glasses between breakfast and dinner, the same quantity in the afternoon, and a couple of glasses before going to bed. The patient is urged to take it whether he wants it or not. He may say that he is not thirsty, but that makes no difference; he must take it as a medicine. The quantity is increased until we have known thirty glasses per day to be taken.

A part of the benefit derived is because of the rest and change of scene; a part, perhaps, is from the small quantity of the salts and other bases contained in these waters (we are not speaking of cathartic or chalybeate waters), but the benefit from this source is very slight. The secret of the cure is in the quantity of water taken. If the water be pure, free from organic matter, and taken in sufficient quantity, the results will be substantially the same, regardless of the "traces" of lithia and small quantities of sodium chloride and other salts. You can perform these cures at home with the ordinary drinking water, if of good quality, if you will require the patient to take it in the same quantity as at the springs. It is very easy to add lithia if desired; but you must not lose sight of the fact that the quantity of water (not lithia) taken is the important thing. It acts by flooding the kidneys; by washing out the bladder with a copious, bland and dilute urine; by unclogging the liver and clearing the brain. The patient feels better from day to day; he is better. Irritable bladder is relieved, the kidneys act freely—are "washed out"—and many effete substances are carried out with the blood; this clears the way for the liver to act freely and normally, for there is an intimate relation between the liver and kidneys.—Med. World.

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THE HEAVENS FOR SEPTEMBER.

BY WILLIAM R. BROOKS, M.A., F.R.A.S.

THE SUN.

The sun's right ascension on September 1 is 10 h. 44 m. 11 s.; and its declination north 8 deg. 1 m. 15 s.

Its right ascension on September 30 is 12 h. 28 m. 37 s.; and its declination south 3 deg. 5 m. 32 s.

On September 22, at 2 h., the sun enters Libra and autumn commences. It will repay the interested student of solar phenomena to watch the sun for sun spots. A very large group has been visible through the early part of July, and this group will doubtless appear again by the sun's rotation early in September. Other spots are also likely to make their appearance.

MERCURY.

Mercury is evening star during the early part of the month. On September 22, at 7 h., it comes into inferior conjunction with the sun and changes to morning star.

On September 8 Mercury is stationary as evening star, and again on September 30 as morning star.

On September 11 Mercury reaches its greatest heliocentric latitude south; and on September 30 it is at its ascending node.

On September 25, at 9 h. 37 m., Mercury will be in conjunction with the moon, when the planet will be 2 deg. 35 m. north of the moon. On September 27, at 6 h., Mercury will be in conjunction with Jupiter, with Mercury 2 deg. 17 m. south of Jupiter.

The right ascension of Mercury on the first of the month is 12 h. 16 m. 19 s.; and its declination south 5 deg. 11 m. 15 s. On the last of the month its right ascension is 11 h. 36 m. 52 s., and its declination north 2 deg. 39 m. 22 s.

VENUS.

Venus is morning star. On September 11, at 11 h., it is at its ascending node. On September 23, at 6 h. 54 m., Venus is in conjunction with the moon, when Venus will be 2 deg. 48 m. north of the moon.

On the first of the month Venus rises at 2 h. 15 m., and crosses the meridian at 9 h. 27 m. A. M. On the last of the month Venus rises at 3 h. 12 m., and crosses the meridian at 9 h. 50 m. A. M.

The right ascension of Venus on the fifteenth of the month is 9 h. 22 m. 4 s., and its declination north 15 deg. 41 m. 4 s.

MARS.

Mars is evening star. It will be in conjunction with the moon on September 27 at 5 h. 51 m., when Mars will be 5 deg. 44 m. north of the moon. On September 1 Mars crosses the meridian at 1 h. 33 m. and sets at 7 h. 32 m. P. M. On the last of the month Mars crosses the meridian at 0 h. 50 m. and sets at 6 h. 20 m. P. M.

The right ascension of Mars on the fifteenth of the month is 12 h. 50 m. 27 s., and its declination south 4 deg. 55 m. 15 s.

JUPITER.

Jupiter is evening star during the early part of the month. On September 13 Jupiter is in conjunction with the sun, and after that date will be morning star. On September 25, at 7 h. 4 m., Jupiter will be in conjunction with the moon, when the planet will be 5 deg. 27 m. north of the moon. The conjunction of Jupiter and Mercury on September 27 has been already mentioned in the section on Mercury. Jupiter will be too near the sun for observations of its satellites during September.

On September 1 Jupiter crosses the meridian at 34 minutes past noon and sets at 6 h. 54 m. P. M. On the last of the month Jupiter rises at 4 h. 50 m. A. M. and crosses the meridian at 11 h. A. M.

The right ascension of Jupiter on the fifteenth of the month is 11 h. 29 m. 14 s., and its declination north 4 deg. 27 m. 50 s.

SATURN.

Saturn is evening star, and fairly well placed for observation as soon as it is dusk.

Saturn will be in conjunction with the moon on September 2 at 5 h. 4 m., when the planet will be 6 deg. 58 m. north of the moon. Saturn will be again in conjunction with the moon on September 30, at 2 h. 33 m., when Saturn will be 6 deg. 36 m. north of the moon.

On the first of the month Saturn crosses the meridian at 4 h. 48 m. and sets at 9 h. 47 m. P. M. On the last of the month Saturn crosses the meridian at 3 h. 2 m. and sets at 8 h. P. M.

The right ascension of Saturn on the fifteenth of the month is 15 h. 36 m. 33 s., and its declination south 17 deg. 26 m. 38 s.

URANUS.

Uranus is in the southwestern evening sky, in the vicinity of Saturn and just below that planet. The right ascension of Uranus on September 10 is 15 h. 33 m. 18 s., and its declination south 18 deg. 58 m. 59 s.

NEPTUNE

Neptune is in the morning sky. On September 14 it is in quadrature with the sun, or ninety degrees west thereof. On September 25 Neptune is stationary. The right ascension of Neptune on the fifteenth of the month is 5 h. 27 m. 48 s., and its declination north 21 deg. 52 m. 46 s.

Smith Observatory, Geneva, N. Y., August 17, 1897.

Burial Places and Causes of Death of Our Presidents.

1. George Washington died from a cold which brought on laryngitis; buried on his estate at Mount Vernon, Va.

2. John Adams died from senile debility; buried at Quincy, Mass.

3. Thomas Jefferson died from chronic diarrhea; buried on his estate at Monticello, Va.

4. James Madison died of old age; buried on his estate at Montpelier, Va.

5. James Monroe died of general debility; buried in Marble Cemetery, New York City.

6. John Quincy Adams died of paralysis, the fatal attack overtaking him in the House of Representatives; buried at Quincy, Mass.

7. Andrew Jackson died of consumption and dropsy; buried on his estate, the Hermitage, near Nashville, Tenn.

8. Martin Van Buren died of catarrh of the throat and lungs; buried at Kinderhook, N. Y.

9. William Henry Harrison died of pleurisy, induced by a cold taken on the day of his inauguration; buried near North Bend, Ohio.

10. John Tyler died from a mysterious disorder like a bilious attack; buried at Richmond, Va.

11. James K. Polk died from weakness, caused by cholera; buried on his estate in Nashville, Tenn.

12. Zachary Taylor died from cholera morbus, induced by improper diet; buried on his estate near Louisville, Ky.

13. Millard Fillmore died from paralysis; buried in Forest Hill Cemetery, Buffalo, N. Y.

14. Franklin Pierce died of inflammation of the stomach; buried at Concord, N. H.

15. James Buchanan died of rheumatism and gout; buried near Lancaster, Pa.

16. Abraham Lincoln, assassinated by J. Wilkes Booth; buried at Springfield, Ill.

17. Andrew Johnson died from paralysis; buried at Greenville, Tenn.

18. Ulysses S. Grant died from cancer of the throat; buried in Riverside Park, New York City.

19. Rutherford B. Hayes died from paralysis of the heart; buried at Fremont, Ohio.

20. James A. Garfield, assassinated by Charles J. Guiteau; buried at Cleveland, Ohio.

21. Chester A. Arthur died from Bright's disease: buried in Rural Cemetery, Albany, N. Y.—Medical and Surgical Reporter.

How to Make a Dark Room Lamp.

Make a box of half inch wood of sufficient size to accommodate a paraffin lamp which you may have, and have about one inch all round or more to spare. Fix a ledge all round the inside of the box half an inch high and half an inch down the box from the open end. Then fit a frame on hinges to one side of the box, and so made that, when shut, it closes up tight against the ledge, and its upper surface is flush with the edges of the box. Then on the opposite side of the box attach another similar frame, hinged to the edge of the box; so that when the first frame is shut down the other frame can be shut over it, fitting flat on the edges of the box. The frames are to be made of half inch wood and about one inch wide, each side. Then fasten buttons on the box to fasten each frame when shut down.

In the top of the box cut a small hole, and arrange a piece of tin over it, so as to let air out, but not light. Similarly with about six small half inch holes in a row at the back of box, along the bottom. This is all the ventilation required. A small hole, say three inches by two inches, at one side is useful, if glazed with ruby glass, both to see how the lamp is going on and to shed a side light over your table, so that you can see where your dishes, etc., are. All you have now to do is to paste one thickness of canary fabric over the first (inner) frame and two thicknesses of ruby fabric over the outer frame. This will give a perfectly safe light for isochromatic plates when both frames are shut, and if you open the outer frame you have a yellow light that is delightful for bromide paper work. Of course, the thicknesses of the fabrics depend on the brightness of the lamp, but the above are safe with a four candle power lamp.

A shade is a very desirable and yet easily made addition. Make one of tin, fastened with a pin at each side and a side stay, so that you can fix it in any position you like, say very far down at the commencement of developing, and move it higher and higher as it goes on. The shade also acts as a protection to the front of the lamp, if it is put away with the shade shut right down. It is also a good plan to wax the fabrics before pasting them on. It secures them from splashes of developer, etc. With a simple arrangement of a projecting pin you can regulate the wick from the outside. For white light, to print bromides or other things, you simply open both doors, and take lamp out if you wish through the front.

You can put a reflector in by getting a piece of sheet tin and cleaning it well; bend it in a semicircle, push it through the front of lamp, and let it go, when it will spring out and fit tightly inside the box. A couple of screws through the back of the box makes this a firmer job, and you will have to cut a hole in the tin if you have a side light as suggested above.—"Hypop.," in Photographic News.

Motor Cycles Break Records.

The race from Paris to Trouville, on August 14, was witnessed by a large number of people. There were sixty-four starters who left St. Germain at 10 o'clock. The conditions were as favorable to speed making as the record established three weeks before in the race from Paris to Dieppe. The distance of 173 kilometers (107 miles) which separated St. Germain from Trouville was covered by M. Jannin, upon the Bollée tricycle, in three hours and fifty-one minutes. M. Jannin also won the Paris-Dieppe race in four hours and thirteen minutes. He therefore managed to cover the distance of three kilometers longer in twenty-two minutes less time.

The winner of the race for carriages was also the winner of the same event in the Paris-Dieppe contest—that is, M. Gilles Hourgieres. Here is an abbreviated list of arrivals in the motocycle class:

	Hours.	Minutes.
First, M. Jannin	3	51
Second, M. Pean	4	28
Third, M. Tetu	4	48
Fourth, M. Comiot	5	25
Carriage class arrivals were:		
First, M. Gilles Hourgieres	4	20
Second, M. Lemaitre	4	21
Third, the Comte de Dion	4	30
Fourth, M. Knyff	4	34

Perfume in Flowers.

The great leading object in nature in providing nectar and fragrance in flowers is still a subject of discussion in scientific journals, says The Independent. That some flowers are unable to fertilize themselves and must have the aid of insects is certain; and it is also certain that in many cases this fertilization is accomplished by the insect while on foraging expeditions for the sweets which flowers furnish. But these well-ascertained facts cover but a small portion of the ground. The fertilization is as often accomplished by insects in search of pollen as in search of honey; but it is not contended that pollen is given to flowers in order to make them attractive to insects, as is said of the sweet secretions. It is believed that nectar must be of some direct value to the plant, as well as the pollen; and the effort is to find out what is the chief office of nectar in the life history of the flower. Since thought has been turned in this direction a new class of facts is being recorded. In California grows a lupine (Lupinus confertus) which often takes exclusive possession of large tracts of land. It does not yield a particle of nectar. It has bright crimson-violet flowers, and these are produced in such abundance that the color of the mass may be noted at long distances. But it has fragrance. This is so powerful that the traveler notes it long before he meets with the growing plants. The pollen-collecting insects visit the flowers in great numbers. It is believed that cross fertilization can be effected by these pollen-collecting intruders. At any rate, the fragrance would be thrown away if it were provided for the mere sake of advertising for insect aid—as the other numerous species of lupine which have no fragrance are as freely visited by bees for the sake of the pollen as is this species. The cross fertilization is effected as freely without fragrance as with it. This point has been made before, though with no reference to the philosophical questions involved. Fragrant flowers are the exception, not the rule. In some families of plants where there may be several scores of species only one or two are fragrant. This has been especially noted among the wild species of violet. But no one has so far been able to note the slightest advantage in life economy which the sweet-scented ones possess over the odorless ones.

The Meeting of the British Association.

The first session of the British Association for the Advancement of Science was held at Toronto on August 18, at which time the president elect, Sir John Evans, delivered an address. The visitors were welcomed in the afternoon at the Horticultural Gardens. Among those present were Lord Lister, the retiring president, Sir John Evans and Lord Kelvin. The Earl of Aberdeen made brief remarks and was followed by Mayor Shaw. Lord Lister, Sir John Evans and Lord Kelvin responded briefly but appropriately. The address in the evening was listened to by an audience of twelve hundred. After allusions to the large number of Americans present, to the return of the Mayflower's log, to the death of Prof. Cope, Sir John announced that he would undertake no general review of recent scientific progress, but would discuss a question belonging to his own field of study—archæology. At the close of the interesting address, the Governor-General moved a vote of thanks, and Lord Kelvin in seconding the motion paid a handsome tribute to Sir John Evans, and expressed his admiration of Canada's splendid empire. The audience sang "God Save the Queen" before dispersing.

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DISPOSAL OF THE WASTES OF NEW YORK CITY.

Among the many operations which may be classed under the head of sanitary engineering, or are closely allied thereto, the question of the proper disposal of city refuse is occupying just now the foremost place. Its prominence is due to its vast importance and to the fact that it is the latest problem affecting the public health and the city revenues that is being attacked on thoroughly businesslike and scientific lines.

The present article is devoted to the subject of the disposal of the third class of city wastes, officially known as "paper and refuse." What this includes can best be understood by referring to the printed instructions upon the back of the red, diamond-shaped cards which the Street Cleaning Department distributes among the householders to be hung up as a signal that the "paper and refuse" man is to call on his next round. The instructions give a list of a dozen articles which must not be placed in either the ashes or the garbage receptacle, but are to be tied in a separate bundle or placed in old barrels or boxes for collection. The list includes such articles as bottles, rags, old clothes, all kinds of paper, shoes, carpets, leather and rubber scrap, etc. The "et cetera" includes the worn-out product of almost every textile and mechanical trade that ministers to the wants of a household, and the contents of the paper and refuse carts as they are dumped in on the assorting tables reveal a bewildering variety that must be seen to be appreciated.

LOWER END OF SORTING TABLE NEAR THE FURNACE.

If the average citizen were to inspect a pile of this rubbish and were asked to appraise its value, he would probably write it down as worthless; and it is certain that he would never imagine that, even in the days of Tammany rule, the privilege of sorting over the city refuse for one year brought in $90,000 to the city treasury. Still greater would be his surprise to learn that an official estimate of the value of the principal materials collected from the New York dumps places the total at $234,377 per annum.

Now, although, as these figures prove, the household rubbish contains much material that is salable, there will, of course, be a residue that is worthless or, to speak more truly, unmarketable. As this residue cannot be sent to the garbage works, and is not available like ashes for filling purposes, in any scheme of the city for handling "paper and refuse" it was necessary to find some other and suitable means for its disposition.

The plant which forms the subject of our front page illustrations was built for the purpose of enabling the city to sort its own refuse and turn the unsalable residue to account by using it as fuel in a steam generating plant. It consists of a movable sorting table on which the salable material is recovered, and a steam generating destructor in which the residue is completely burnt up, the combustion serving to generate more than sufficient steam to furnish motive power for the plant.

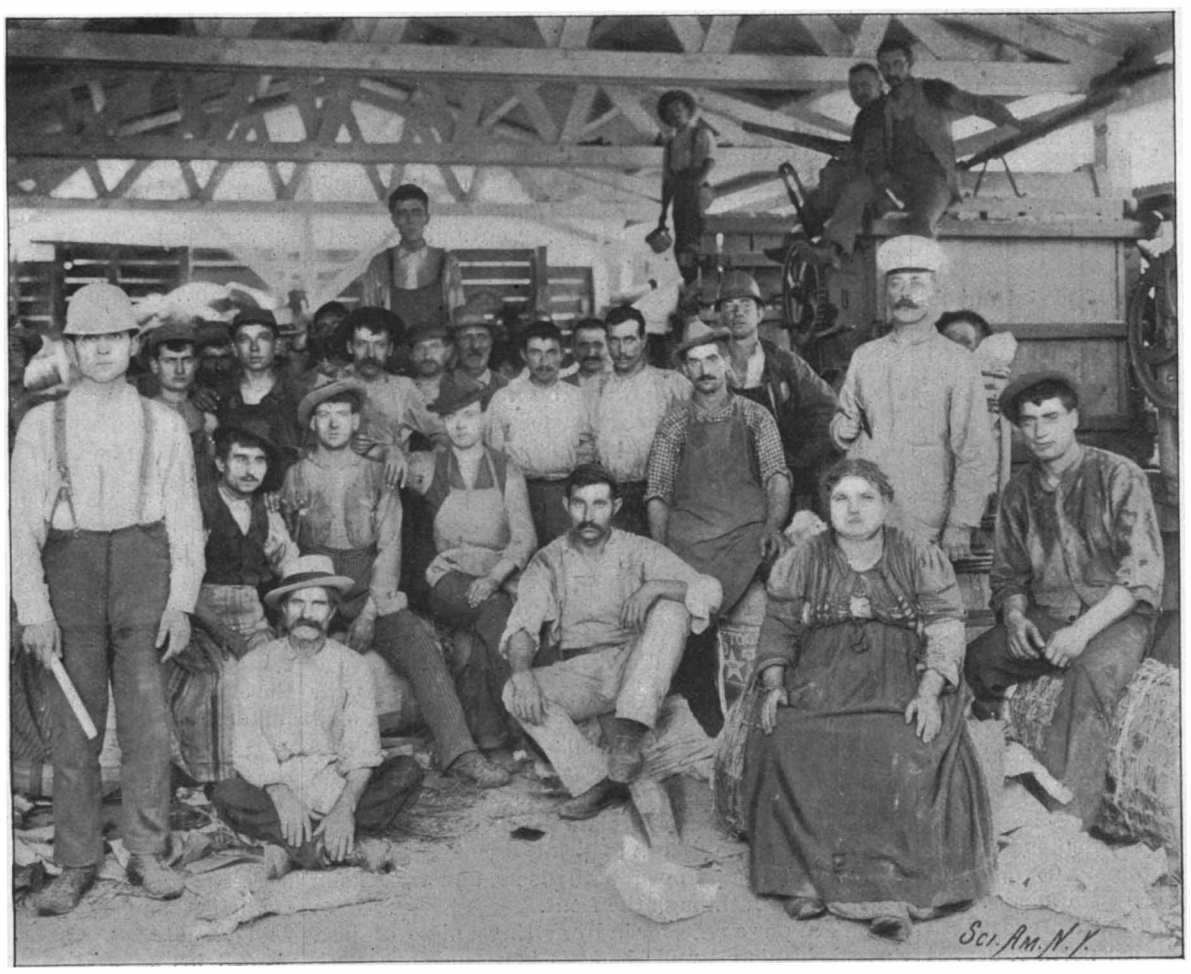
The sorting table consists of an endless canvas belt, 4 feet wide, which travels at a speed of 40 feet a minute above a table which is ranged down one side of the sorting room. The table is about 3 feet above the ground and extends from the dumping hopper, where the rubbish is unloaded from the carts, to the foot of the furnace—a distance of about 80 feet. Here the belt passes over a pulley and returns to a similar pulley below the hopper, the material being dropped onto an inclined belt elevator which discharges it into the top of the furnace. Both belts are provided with transverse slats of wood to give them a good hold upon the material. Ranged on each side of the belt are a number of trained "pickers," whose duty it is to turn over the heap of rubbish and take out the valuable material. Each man has to watch for a particular class of matter, and as he picks it out he throws it into empty barrels which are placed conveniently around him. There is a great difference in the value of the various kinds of refuse, and an endeavor is made to save the most valuable first. Consequently the pickers who stand nearest the dump carts are occupied in collecting the various kinds of paper in their order of value. Five grades of paper are recognized: Ledger paper, manila, folded newspapers, commons and strawboard. The next set of men pick out the different grades of "rags," in which are included clean whites, soiled whites, woolens, blacks, mixed and twine. Carpets are taken out according as they are woolens, hard back or soft back. Next the slowly moving and now considerably reduced strip of rubbish is relieved of its "bagging," and after this the "bottles" are taken out and dropped into their proper receptacles. Tin cans come next, and then shoes and rubber are taken out. By this time the rubbish is getting near the inclined belt which leads up to the furnace, and the last few pickers take out the metals, including copper, zinc, brass and iron, and any miscellaneous matter that may have a market value or be incombustible in the furnace.

The residue now falls over the end of the belt onto the elevator and is carried up to the mouth of the furnace. If the aforesaid citizen who designated the contents of the paper and rubbish carts as worthless could watch the scanty remnants that find their way up to the furnace, as shown in the illustration, he would receive a lesson in economy whose impression would last him a lifetime.

The assorted material in the baskets is taken to presses which are arranged in a row parallel to the table, where it is made up into bales, labeled and stacked on one side of the room ready for shipment to the dealers. The bales are piled in separate lots according as they are made up of "ledger" paper, "manila," "white rags," "hard" or "soft" back carpets, etc. The prices paid for this material vary greatly. Print papers bring $5 per ton; folded newspapers, $8 to $9 per ton; manila, from $10 to $17; and letters and ledgers from $27.50 to $37.50 per ton. It may interest our readers to know that in New York City alone the trade in waste paper and rags suitable for paper manufacture is estimated to reach an annual value of $1,755,000.

The bottles collected from the table are assorted according to their various kinds, and sold to the junk dealers, three classes being recognized: 1. Beer and soda water bottles. 2. Milk bottles. 3. Miscellaneous. Those which have the proprietors' names blown in them are sold to a dealer who sells them to the Bottlers' and Manufacturers' Association of New York, which in turn distributes them to the owners. The magnitude of this trade alone may be judged from an estimate by one of the leading dealers, who puts down the collections from the city dumps at about 500 barrels a week. This would represent a yearly value, at the market price, of about $40,000.

The old shoes are sorted according to their quality. Those which can be made to pair and are in fair condition are sold to tenement district shoemakers and cobblers at 15 cents a pair and the rest at 5 cents a pair. The balance of the salable material is bought by the various junk dealers, and what cannot be sold or burnt (a remarkably small percentage, by the way) is carried to the dumps.



A GROUP OF EXPERT RAGPICKERS.

The steam generating furnace is a rectangular brick structure 12 feet wide, 9 feet deep and 16 feet high, with walls and roof of a uniform thickness of 2 feet. It is lined throughout on the inside with 9 inches of firebrick, and immediately back of the firebrick is a series of flues or air spaces from which hot air is drawn into the furnace above the grates, to assist in producing a perfect combustion. There are three watertube grates, one above the other, which slope in alternate directions. When the material falls into the furnace through the shoot situated near the roof, it drops onto a grate which slopes forward and reaches half way across the furnace. From this it drops

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onto a second grate, which slopes in the reverse direction from the opposite wall, and also extends half way across the furnace; from this it falls onto the last grate, which reaches entirely from wall to wall. Above each grate a large number of tuyeres admit hot air to the incandescent mass of rubbish (which, from its nature, tends to become matted on the grates) and help to keep it in active combustion. Each grate consists of a set of water tubes which terminate at the lower end in a water pipe and at the upper end in a steam pipe. The several water pipes are connected together and are fed at the bottom by a small donkey pump.

The steam and gases are led to a horizontal tubular boiler which is mounted a few feet distant from the furnace. The steam which collects in the steam pipes is carried into the steam drum. The gases are conducted by a flue into the lower part of the combustion chamber. They are then drawn through the tubes and pass through a suction fan and a cyclone dust separator, finally escaping to the stack.

It was necessary in designing the furnace to provide that the gases should pass out of the smoke stack free from smoke and dust, and it was this consideration that governed the arrangement of this part of the plant. It was decided to use both the "induced" and the "down draught" system in the furnace, and, consequently, a fan, driven by a direct-connected engine, was placed midway, as shown, between the auxiliary boiler and the smoke stack. The air is drawn in at the top of the furnace and passes down through the three grates. The heat of the gases was too great to admit of using a fan at the exit from the bottom grate; but by using the second boiler the temperature was lowered to 750 degrees, and another 100 boiler horse power was realized. The furnace consumes from 1 pound to 1½ pounds of rubbish per square foot of grate surface per minute. The boilers furnish sufficient steam to run the 20 horse power fan engine, the 5 horse power engine for running the sorting table and the feed pump, and steam at 70 pounds pressure is continually being blown away through a 3½ inch steam pipe.

The cyclone dust separator consists of an inner and outer cone and a set of four spiral vanes which divide the space between the cones into four spiral passageways. As the furnace gases are blown through these they acquire a whirling motion, and the centrifugal effect drives the heavy particles of dust to the outer wall, where they pass through a narrow slot into the dust box, which, by reference to the engraving, will be noticed just below the separator. That this apparatus is remarkably efficient is proved by watching the top of the smoke stack, which is free from smoke and dust and gives no indication that the furnace is at work.

The refuse which is brought to this plant, which is located near the foot of East Eighteenth Street, is gathered in the surrounding district. It would not pay to cart it from distant parts of the city. If the plan proves financially and otherwise successful, it is intended to establish similar plants at various points to be subsequently determined upon. Our thanks are due to Commissioner Waring, of the New York Street Cleaning Department, and to Mr. L. Colwell, the designer of the furnace and boilers, for courtesies extended during the preparation of the foregoing article.

"PAPER AND REFUSE" CARTS AND BALING PRESSES.

Carbide of Silicon in the Manufacture of Steel.

The American Engineer and Car Builder, referring to the patent issued recently to Alfred E. Hunt, Benjamin Talbot, and Percival Roberts, on the use of carbide of silicon in the manufacture of steel, adds: Carbide of silicon is made by passing an electric current through a cove of sand mixed with coke. The finer and better grade is used as an abrasive, but there is produced considerable material which is not valuable for that purpose and can be sold cheaply. It has been used experimentally at Pencoyd. It is split up and gives both silicon and carbon to the molten steel. It quiets and solidifies the metal and may become useful in the manufacture of castings and other specialties when solid metal is desired. It has the advantage over ferro-silicon, with 10 to 12 per cent of silicon, because the silicon in the carbide is concentrated, the carbide containing about 70 per cent of silicon and 30 per cent of carbon.

PROF. DE MAIN WOOD AND HIS ORCHESTRAL GUITAR.

THE ORCHESTRAL GUITAR.

It is not often that the gift for music and the gift for practical mechanics exist in the same individual; but it must be admitted that the really wonderful instrument which we show in the accompanying illustrations proves that this rule, like many others, has its exceptions. Generally speaking, the attachments which are occasionally fitted to guitars, harps, and other stringed instruments are not a musical success—whatever may be their mechanical merit; but after listening to the vox humana and mandolin effects, as rendered by Prof. Wood, of Muncie, Indiana, in this office, we are free to confess that he has achieved a brilliant success in the problem which he set out to accomplish some 15 years ago.

In naming it the orchestralguitar the inventor has aptly described the difference between his instrument and the ordinary guitar. The various attachments which have so completely changed the appearance of the instrument enable the player to combine the tones of the guitar, the mandolin, and the zither and to rival the finest vox humana effects of the organ or the violin.

There are in all four special attachments, as follows: 1. A subfinger board with four additional bass strings. 2. A mouthpiece for fingering the first string of the guitar. 3. A mandolin attachment. 4. A voice attachment.

On the neck of the guitar is fastened an extra piece of rosewood, the back of which is fitted in the same way as the ordinary finger board. The extra strings are strung along the under side of this board and they are fingered by the thumb of the left hand. It is thus possible to produce a chromatic scale of the bass notes without a multiplication of strings, as in the regulation subbass guitar. The boxlike structure, E, attached to the base of the guitar is the mandolin attachment. Of all the novel parts, this is the only one that is purely mechanical, the movement of the pickers being controlled by clockwork. The powerful driving springs are placed within the body of the instrument and firmly secured to the floor as shown in Fig. 3.

The controlling mechanism is contained within the box, F, from which a small shaft extends forward over the sounding board and carries at its outer end a little wheel armed with a series of steel wire pickers, C. The wheel with its pickers is housed in the half round cover shown in the engraving. Above the cover is a little lever, B, by which the clockwork is started or stopped. When the mechanism is started the wheel and pickers, which are located just above the first guitar string, begin to rotate at a regular speed. Normally they are kept clear of the string by a spring; but when the player wishes to produce the mandolin effect, he presses the little button, C, and brings the pickers down upon the string, keeping it there as long as he wishes to use the tremolo effect. The attachment, A, is merely a handrest which is used in manipulating the above described parts. To give the pickers the desired resiliency they each contain a spring coil between the striking point and the point of attachment to the wheel. It will be seen that as the speed of the wheel is uniform, the number of strokes may be determined to a nicety by depressing the button, C, for a longer or shorter time, one stroke only being made, if desired. The result of this mechanism is an

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exeellent reproduction of the mandolin effect, the tremolo being very perfect.

The fingering of the first string is not done by hand, but by the mouth, or rather by an attachment worked by the mouth. This consists of an L shaped piece of rosewood, L, the longer arm of which slides upon a steel bar, K, which is rigidly attached to the guitar. The smaller arm extends across the strings and carries a wheel, I, which is thus capable of being moved up and down the finger board and pressed down upon the first string in the same way as the finger in ordinary playing. The movements of the wheel are controlled by a small brass rod which slides in a roller bearing in the bracket which carries the wheel, the rod itself being carried by a mouthpiece, as shown in the engraving. To prevent the metallic sound which would result from the first contact of the brass wheel and the string, a small damper, J, is provided, which normally hangs a little below the bottom of the wheel. When the wheel is depressed, the damper deadens the string before the wheel comes in contact with it, but rises as soon as the wheel is down in place. In raising the wheel the damper is again automatically dropped, holding the string quiet until the wheel is clear.

Undoubtedly the most successful and ingenious device is the voice attachment, by which Mr. Wood secures the sympathetic effect which is sought for in the vox humana stop of the organ. Among the stringed instruments the violin alone has hitherto been capable of producing this exquisite effect, and the greatest credit is due to the mechanical ingenuity of the inventor that the same result should have been obtained on a guitar. The variation in the tone is produced by varying the tension in the string, the latter result being obtained by means of the lever, F, and a small bellows situated beneath the neck of the guitar, Fig. 2. The lever is pivoted on the pin, G, on which is also a small loose sheave or pulley. Above G, and attached to the lever, is another small pulley. The string is led over the second and under the first mentioned pulley before being carried to the tuning peg. The further end of the lever is linked to a small bellows, which is blown by means of a rubber tube, H, which leads to the

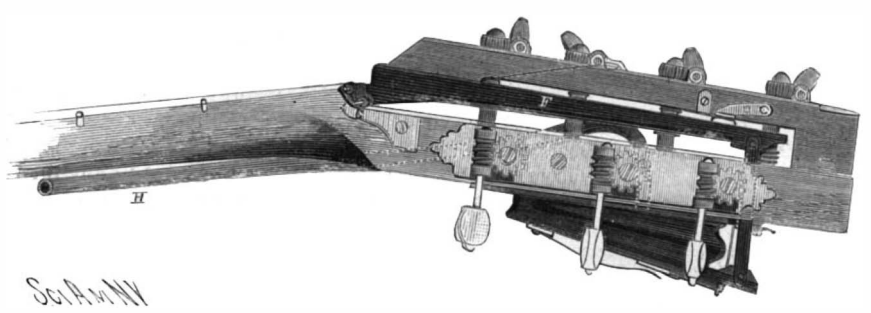

Fig. 2.—THE "VOX HUMANA" ATTACHMENT.

mouthpiece already mentioned. Now it will be seen that as the air is blown in or exhausted from the bellows the long arm of the lever will be raised or lowered. This will alternately tighten or slacken the string and produce a variation in the tone answering to the shake in the voice of a singer. By means of a flexible stop the string is brought to rest in the midposition of its length answering to the normal tone.

This most ingenious device produces results which must be heard to be fully appreciated. The throat is brought into intimate union with the guitar string, and the breath literally plays upon it as it would upon the vocal cords themselves, producing the voice effect with remarkable range and reality.

This instrument is the first and only one of its kind that has ever been made, and is unique also in the fact that there is only one person in the world who can play it.

Joseph's Canal in Egypt.

How many of the engineering works of the nineteenth century will there be in existence in the year 6000? Very few, we fear, and still less those that will continue in that far-off age to serve a useful purpose. Yet there is at least one great undertaking conceived and executed by an engineer which during the space of 4,000 years has never ceased its office, on which the life of a fertile province absolutely depends to-day. We refer, says Engineering, to the Bahr Joussuf—the canal of Joseph—built, according to tradition, by the son of Jacob, and which constitutes not the least of the many blessings he conferred on Egypt during the years of his prosperous rule.

This canal took its rise from the Nile at Asiut, and ran almost parallel with it for nearly 250 miles, creeping along under the western cliffs of the Nile Valley, with many a bend and winding, until at length it gained an eminence, as compared with the river bed, which enabled it to turn westward through a narrow pass and enter a district which was otherwise shut off from the fertilizing floods on which all vegetation in Egypt depends. The northern end stood seventeen feet above low Nile, while at the southern end it was at an equal elevation with the river. Through this cut ran a perennial stream, which watered a province named the Fayoum, endowing it with fertility and supporting a large population. In the time of the annual flood a great part of the canal was under water, and then the river's current would rush in a more direct course into the pass, carrying with it the rich silt which takes the place of manure and keeps the soil in a constant state of productiveness. All this, with the exception of the tradition that Joseph built it, can be verified today, and it is not mere supposition or rumor.

Until eight years ago it was firmly believed that the design has always been limited to an irrigation scheme, larger, no doubt, than that now in operation, as shown by the traces of abandoned canals, and by the slow aggregation of waste water which had accumulated in the Birket el Querum, but still essentially the same in character. Many accounts have been written by Greek and Roman historians, such as Herodotus, Strabo, Mutianus, and Pliny, and repeated in monkish legends, or portrayed in the maps of the middle ages, which agreed with the folk lore of the district. These tales explained that the canal dug by the ancient Israelites served to carry the surplus waters of the Nile into an extensive lake lying south of the Fayoum, and so large that it not only modified the climate, tempering the arid winds of the desert and converting them into the balmy airs which nourished the vines and the olives into a fullness and fragrance unknown in any part of the country, but also added to the food supply of the land such immense quantities of fish that the royal prerogative of the right of piscary at the great weir was valued at £250,000 annually. This lake was said to be 450 miles round and to be navigated by a fleet of vessels, and the whole circumference was the scene of industry and prosperity.

Killing Germs in Books.

Science takes the well-thumbed volume, dear to our ancestors, forgets all the pathos in it and finds instead germs. And most people would confess that sentiment comes a little dear when it carries typhoid or diphtheria along with it.

Such, at any rate, is the opinion of the authorities of the New York Public Library. When the reservoir is removed from Bryant Park, and in its place is a splendid library, there will be a free lending department, as well as the reading rooms and reference library. Every inhabitant of New York of good character will be able to borrow books free of charge, and the Public Library authorities have been for some time considering how the dangers inevitably resulting from circulating volumes in every part of the city may be avoided. Preventive measures are naturally out of the question. It would be as impossible to discover whether every volume lent would be used by persons free from diseases as to prophesy where such diseases were about to break out. The measures taken must be corrective, and the question resolved itself into an inquiry as to whether a satisfactory disinfectant could be found.

For some time Dr. John S. Billings, director of the library, has been experimenting in order to discover a perfect disinfectant. Last year Mr. Horton, under Dr. Billings' direction, conducted a series of experiments in the latter's laboratory in Philadelphia. A number of old Patent Office reports were inoculated with bacteria, and in a short time the books were full of germs of measles, scarlet fever, smallpox, and other diseases.

Trials were then made of various germ-destroying substances, and as a result of the experiments Dr. Billings says that he has a perfect disinfectant in the gas formaldehyde. The volume is placed in a glass or metal box with a saucerful of a solution of formalin in water, and left for an hour or two. At the end of that time the vapor has penetrated into every particle of the book and not a live germ can be found.

The process will be used in the circulating department of the New York Public Library, and the patrons of the institution may ease their minds of any fear that the volumes they borrow may bring the dreaded germs of diphtheria or typhoid fever into their houses.

Bibliophiles, too, will be glad to know that the formalin will destroy the Croton bug, responsible for the ruin of so many fine bindings in this country. The traditional book worm is now a rarity in America, but the Croton bug has taken its place, and the collector of Le Gascons or Groliers has in Dr. Billings' discovery a preventive of the ravages that the insect's passion for morocco and calfskin causes.

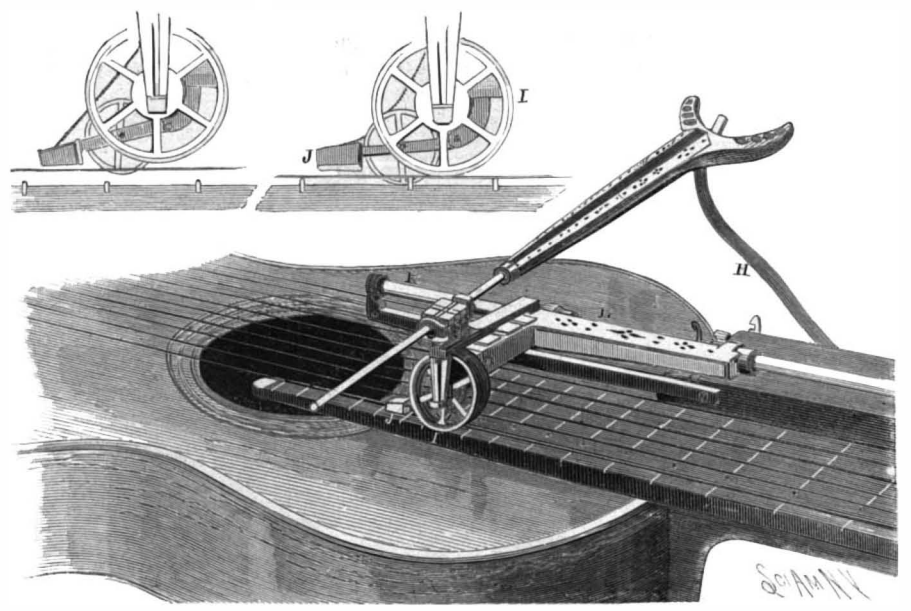

Fig. 1.—MOUTHPIECE AND FINGERING MECHANISM.

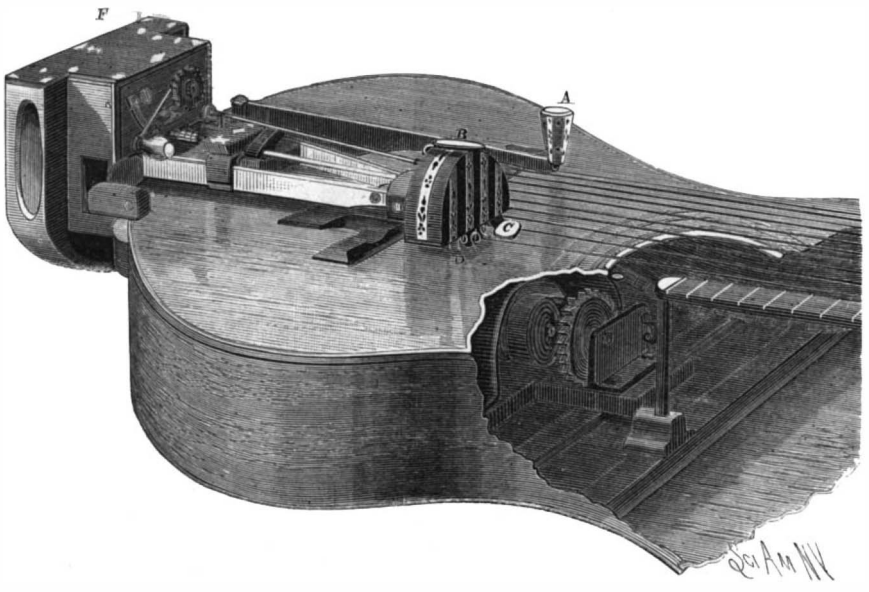

Fig. 3.—THE MANDOLIN ATTACHMENT.

King Menelik's Library.

As most people know, some of our most valuable old manuscripts, especially Bible manuscripts, have come from Abyssinia. How many more rich finds may yet come out of that region one can only surmise. It is interesting to learn from La Naturaleya, Madrid, that "at the time of the Mohammedan invasion of Ethiopia, in the sixteenth century, the Abyssinians placed all their Ethiopian manuscripts in Debra-Sina, one of the islands on Lake Zonay, and here they remained carefully guarded by the inhabitants, who looked upon the books as tutelary deities. Not long ago the negus sent an expedition to conquer these holy islands, and has built in his capital, Addis-Ababa, a library for the reception of the manuscripts thus recovered. In ancient times Ethiopia was a great center of learning, and some of these manuscripts have doubtless extreme value."

It is exactly two hundred years since the cities of France have been lighted at night, though Chief of Police La Reyaie had caused lanterns to be used regularly in Paris thirty years before. In the edict issued by King Louis XIV in 1697, ordering the innovation, he says: "Of all the arrangements made in our good town of Paris, there is none whose usefulness is clearer and more generally admitted than that of the lanterns which light the streets; and as we believe it our duty to care no less for the safety and convenience of the other towns in our kingdom, we have determined to establish the same system in them and to provide the means for continuing it forever." The system consisted in hanging a lantern with a lighted candle in it across each end of a street, and one across the middle of the longer streets.

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SPIRITUALISTIC TIES.*

BY W. B. CAULK.

The following article is not written with the intention or desire to antagonize any believer in spiritualism, but merely to explain how anti-spiritualists, as well as several professional "mediums," secured their release after being fastened in their cabinet. During the years the writer has been before the public as a magician and cabinet performer he has met a number of cabinet test "mediums," and can safely say that all of these people who have come under his observation have been impostors. This may be due, however, to the bad fortune of the writer.

The writer has been tied with ropes, fastened with handcuffs, brass collars, and chains, many times in many different cities, and by people who were just as alert as any investigator of spiritualistic phenomena, yet, unlike many "mediums" he has met with, was never exposed.

The methods used are many, some simple, others complicated, but all mystifying. To the average auditor the most wonderful point is, how does the performer release himself after being so securely bound? For the benefit of the curious the writer will explain a few of the methods by which he has secured his release after being fastened by a committee from the audience. All anti-spiritualists, as well as several "mediums" personally known to the writer, make use of these same methods of release, or others founded on the same principle.

Among the many successful rope tests, the following is about the best. A piece of soft cotton rope about six feet long, and of the size known as sash cord, is securely tied around the performer's left wrist, dividing the rope so that the ends will be of an equal length. When the committee is satisfied that they have made the knots secure, the performer places his hands behind him, with the right wrist resting over the knots on the left wrist, and the ends of the rope are securely tied together, bringing the knots down tight on the right wrist. This appears fair enough, but it is not as fair as it appears, because, while the knots are secure enough, there is sufficient slack between the wrists to enable the performer, by giving his right wrist a half turn, to withdraw this hand from the rope encircling it.

The reader may say, "That is all well enough, but how and by what means does he secure this slack?"

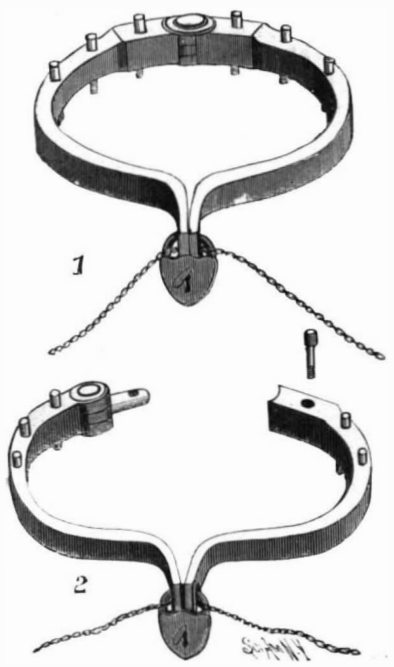
In placing his hands behind him after the rope is tied about the left wrist, he gives the rope a twist, crossing one end over the other, pressing the twist down on the knot and covering the twist and knot with the right wrist, which is then tied. When ready to release himself, the performer gives his right hand and wrist a half turn, releasing the twist lying on the knot, which thus becomes a part of the loop tied around the right wrist, and enlarging it sufficiently to enable the performer to pull the right hand free from the rope, when he can perform any trick he chooses with the free hand. Our first and second engravings show the formation of the twist, thus making the above explanation clear. By replacing the hand in the loop and giving the hand a half turn the knots can be shown as secure as when first tied.

The handcuff test is a great favorite of the "medium." In this test the performer uses any pair of handcuffs furnished by the audience, and by them put on him. Yet, in a very few moments after he takes his place in the cabinet, his coat is thrown out, but on examination the handcuffs are found to be on his wrists just as they were placed by the audience. As a final test, the performer comes out of the cabinet holding the handcuffs in his hand, removed from the wrist but locked.

The explanation of this trick is very simple, but, like many simple tricks, very mysterious. There are only a few styles of handcuffs made in this country, and all that a "medium" has to do is to secure the proper key for each style, which keys are concealed about the person, and by the aid of fingers and teeth the proper key can be fitted to the handcuffs. In some types of handcuffs it is impossible to get the fingers to the keyhole. If such a pair is placed on the performer and he cannot use his teeth to hold the key, he slips the key in a crack in the chair or cabinet, which crack he makes sure is there before undertaking the test, thus holding the key and unlocking the handcuffs.

As the space allotted for this article is limited, the writer will explain but one other piece of apparatus used to secure the "medium," which is known as the spirit collar.

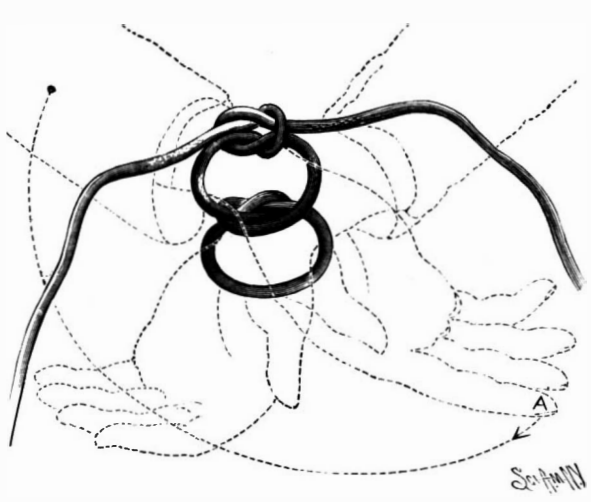
The collar is made of brass, and fits closely about the performer's neck. Through the openings in the ends of the collar is passed a chain, after the collar is on the performer's neck, and this chain is passed around a post, carried back and through the padlock which is used to lock the collar. By this arrangement the performer is fastened securely to a post—at least it appears so to the audience. This collar is shown in our engraving. As seen by the cut, the collar is decorated with a



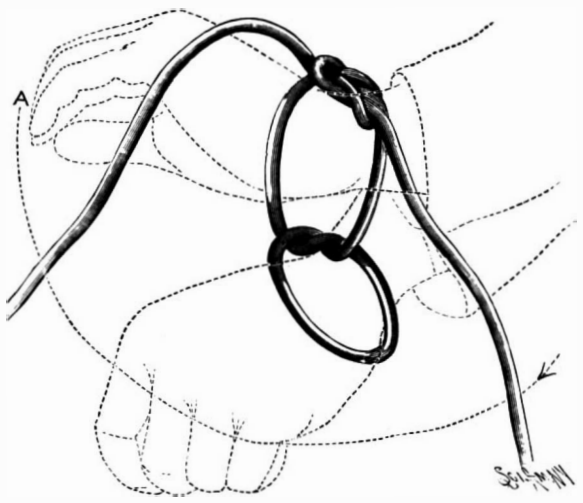
THE SPIRIT COLLAR.

number of small bolts, which impart to it an additional appearance of strength.

These bolts are all false, with one exception. This genuine bolt can be removed by the performer when the collar is on his neck, thus allowing the collar to come apart at the hinge, as shown in the cut, thus releasing the performer, allowing him full liberty to perform any trick he wishes, and permitting him to again apparently fasten himself securely. This loose bolt fits so securely that there is no danger of any of the committee removing it with their fingers. The performer uses a small wrench to remove the bolt.



A ROPE TEST.



EXPLANATION OF THE ROPE TEST.

Great Inventions of Thirty Years.

Inventions of the first order have been very numerous during the past thirty years. The decade 1866–76 marks the beginning of the most remarkable period of activity and development in the history of the world. The American Woodworker numerates the following as the most important of these. The perfection of the dynamo and its twin brother, the electric motor, by Wilde, Siemens, Wheatstone, Varley, Farmer, Gramme, Brush, Weston, Edison Thomson, and others brought the great development of the electric light and electric railways. Then appeared the Bessemer process of making steel, dynamite, the St. Louis bridge, Westinghouse air brake, and the middlings purifying and roller processes in milling. That great chemist, Louis Pasteur, added his work to this period; the Gatling gun appeared; great developments were made in ice machines and cold storage equipments; machines for making barbed wire fences; compressed air rock drill and the Mont Cenis tunnel; pressed glassware; Stearns' duplex telegraph and Edison's quadruplex; the cable car system of Hallidie and the Janney car coupler; the self-binding reaper and harvester, the tempering of steel wire and springs by electricity; the Low process for making water gas; cash carriers for stores, and machines for making tin cans.

With the next decade, 1876–86, there arose a star of the first magnitude in the constellation of inventions. The railway and telegraph had already made all people near neighbors, but it remained for the Bell telephone to establish the close kinship of one great talkative family, in constant intercourse, the tiny wire, sentient and responsive to the familiar voice, transmitting the message with tone and accent unchanged by the thousands of miles of distance between. Then come in order the hydraulic dredges; and Mississippi jetties of Eads; the Jablochkoff electric candles; photography by electric light; the cigarette machine; the Otto gas engine; the great improvement and development of the typewriter; the casting of chilled car wheels; the Birkenhead and Rabbeth spinning spindles, and enameled sheet iron ware for the kitchen. Next the phonograph of Edison appears. In this decade we find the first electric railway operated in Berlin; the development of the storage battery; welding metals by electricity; passenger elevators; the construction of the Brooklyn bridge; the synthetic production of many useful medicines, dyes and antiseptics from coal tar products, and the Cowles process for manufacturing aluminum.

In the last decade, 1886–96, inventions in such great numbers and yet of such importance have appeared that selections seem impossible without doing injustice to the others. The graphophone; the Pullman and Wagner railway cars and vestibuled trains; the Harvey process of annealing armor plates; artificial silk from pyroxyline; automobile or horseless carriages; the Zalinski dynamite gun; the Mergenthaler linotype machine, moulding and setting its own type, a whole line at a time, and doing the work of four compositors; the Welsbach gas burner; the Krag-Jorgensen rifle; Prof. Langley's aerodrome; the manufacture of acetylene gas from calcium carbide; the discovery of argon; the application of the cathode rays in photography by Roentgen; Edison's fluoroscope for seeing with the cathode rays; Tesla's discoveries in electricity and the kinetoscope, are some of the modern inventions which still interest and engage the attention of the world, while the great development in photography and of the web perfecting printing press, the typewriter, the modern bicycle and cash register is so great as to defy measurement.

Ancient Extravagance.

The great display of jewels by women of fashion on both sides of the ocean has been severely criticised, even by those who could well afford to wear them if they desired to. But if the precedent of history furnishes any justification for this fashion, the jewel wearers of the present day are thoroughly justified. According to Pliny, Lollia Paulina, the wife of Caligula, wore on her head, arms, neck, hands and waist, pearls and emeralds to the value of one million six hundred and eighty thousand dollars. Faustina had a ring worth two hundred thousand dollars. Domitia had one worth three hundred thousand dollars, and Kæsonia had a bracelet worth four hundred thousand dollars. Seneca bewails that one pearl in each ear no longer suffices to adorn a woman; they must have three, the weight of which ought to be insupportable to them. There were women in ancient Rome whose sole occupation was the healing of the ears of the belles who had torn or otherwise injured the lobes with the weight of their pendants. Poppæa's earrings were worth seven hundred and fifty thousand dollars, and Cæsar's wife, Calpurnia, had a pair valued at twice that sum. Marie de Médicis had a dress made for the ceremony of the baptism of her children which was trimmed with thirty-two thousand pearls and three thousand diamonds, and at the last moment she found it was so heavy she could not wear it and had to get another. But men led in the splendor of the middle ages, and Philip the Good, of Burgundy, often wore jewels valued at two hundred thousand dollars. When he walked along the streets the people climbed over each other to look at him. The Duke of Buckingham wore a suit at the Court of St. James which cost four hundred thousand dollars. The dress of the nobles during the middle ages was literally covered with gold and precious stones.—San Francisco Chronicle.

AFTER the great fire of 1872, says an exchange, the cost of bricks laid in the wall was ordinarily reckoned in Boston at $36 a thousand. Now, better bricks, quite as well laid, with better lime and cement, cost there, in the wall, $15 a thousand. Fireproofing processes have been greatly improved and cheapened, so that an ordinary mercantile building can be erected, with floors, roof and partitions all of iron and concrete, or terra cotta, for 10 to 15 per cent more than it would cost with cheap wooden floors.

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The Colors of Birds.

A remarkable law of nature has only recently been discovered and formulated by the artist, Mr. Abbott H. Thayer, says the Home Journal. For more than a generation of men, naturalists have been studying the part which color plays in protecting animals from their enemies. Protective coloration is the technical name which is given to such cases of protection, and much keenness of observation and of reasoning has been shown by students of the great problems of evolution. Yet no naturalist has ever perceived the secret of protective coloration, which, as the name suggests, lies in the painter's province, and might never have been discovered by naturalists.

"The law of gradation in the coloring of animals," says Mr. Thayer, "is responsible for most of the phenomena of protective coloration except those properly called 'mimicry.' Mimicry makes an animal appear to be some other thing, whereas this newly discovered law makes him cease to appear to exist at all. For example, the screech owl, when startled, makes himself tall and slim, and, with eyes shut to a narrow line, simulates a dead stub of the tree on which he sits. Certain herons stretch their necks straight upward, and, with head and green beak pointed at the zenith, pass themselves off for blades of sedge grass. Many butterflies have stone or bark colored under sides to their wings, which make them look like a bit of bark or lichen when they sit still on a stone or tree trunk, with wings shut over their backs. The newly discovered law may be stated thus: Animals are painted by nature darkest on those parts which tend to be most lighted by the sky's light, and vice versa."

The ruffed grouse is a bird which shows the gradation in its simplest form, the color making a complete gradation from brown above to silvery white beneath. The top light makes him so like his surroundings that he is nearly, if not quite, obliterated. The cause of this obliteration has been assigned to the fact that his color is like that of the surroundings. Mr. Thayer ingeniously proves not only that, were he colored like his surroundings, he would be completely visible, but proves at the same time what the true cause of his concealment is. He carefully and accurately painted a dead grouse on the lower part of the body with brown to match his back, and painted the sides in gradation till the bird was uniformly colored all over, except that the upper surfaces were left as nature painted them. He then set the bird up in a lifelike position on the ground. The effect was magical. What was before almost invisible at a short distance became clearly visible, proving that it is only this gradation of color which deserves the name of protective coloration, and that it is the compound gradation made by the daylight's co-operation which conceals the animal.

Mr. Thayer made some wooden eggs of about the size of a woodcock's body, and mounted them on wire legs about six inches above the ground. Most of them were colored in imitation of the color gradation of a grouse or a hare, being earth color above to pure white beneath. To two of the wooden eggs he gave a coat of earth color all over, and then set the whole, like a flock of shore birds, on the bare ground in a city lot. He then invited a naturalist to look for them, beginning at a distance of forty or fifty yards. The naturalist saw immediately the two monochrome ones; but, although he was told exactly where to look, he failed to find any of the others till he was within six or seven yards of them, and even then he saw them only by knowing exactly where to look.

The reader can easily get an illustration of this law with no more trouble than merely using his eyes. Look at a horizontal branch or a twig of a tree in the woods, which is either on the level of the eye or below it. You will see that, although it has exactly the color of its surroundings, it is not at all concealed. This is because it is of uniform color above and below, and wears that uniform attitude of a solid—a gradation of shade from its light side above to its dark side beneath. This is the case of the painted grouse—mentioned above—right over again.

On November 9, 1896, Mr. Thayer gave an open-air talk, demonstrating his theory of protective color, to naturalists gathered from all over the country. He placed three objects, of about the size and shape of sweet potatoes, horizontally on wires a few inches above the ground. They were covered with a sticky material, and then dry earth from the road where they stood was sprinkled over them to give them the same color as their background. The two end ones were then painted white on the under sides, and the white color was shaded up and gradually mixed with the brown of the sides. When viewed from a little distance, these two end ones, which were white below, disappeared from sight, while the middle one stood out in strong relief, and appeared much darker than it really was. Mr. Thayer explained that terrestrial birds and mammals, which are protectively colored, have the under parts white, or very light in color, and that the color of the under parts usually shades gradually into that of the upper parts. This is essential in order to counteract the effect of the shadow side, which otherwise, as shown by the middle potato, makes the object abnormally conspicuous, and causes it to appear much darker than it really is. In the case of Mr. Thayer's experiment some of the witnesses could hardly believe that the striking difference in the visibility of the three potatoes was entirely due to the coloring of the under sides, and Mr. Thayer was asked to color the middle one like the two others, in order that the effect might be observed. Mr. Thayer complied with the request, painting the under side of the middle potato white, shading the white up into the sides, as in the case of the others. The effect was almost magical. The middle potato at once disappeared from view. A similar experiment was tried on the lawn. Two potatoes were painted green, to resemble the green of the grass above which they were suspended. One was painted white on the under side, and at once became invisible when viewed from a little distance, while the other showed plainly and seemed very dark, the shadow, superadded to the green of the under side, making it remarkably conspicuous. The experiments were an overwhelming success.

This device of nature is operative throughout the animal kingdom, the marine world offering scarcely any exceptions from its universality. When we realize that to this color gradation the animal kingdom, with few exceptions, owes its present status—that it everywhere finds this fact a balance wheel to check the rate of destruction of one species by another—the universality of the principle makes its discovery a great one.

RECENTLY PATENTED INVENTIONS.

Mechanical.

CUTTER HEAD AND KNIFE.—James B. Vuncanon, Asbeborough, N. C. To improve the efficiency and durability of rotary cutter heads for surface planing and moulding machines, and for the improved adjustment of the knives, the cutter head stock is four-sided, according to this invention, the knives having transverse slots, and the clamping plates having rabbets of the same depth as the thickness of the knives, there being two transverse rows of aligned screw-threaded holes in the under side of the rabbeted portions. Screws passing through and countersunk in the slots of the knives are adapted to enter any of the holes, the knives being thus adapted for individual adjustment and also for adjustment together with the screws. Fitting strips extend between the backs of the knives and the shoulders of the rabbets, and have lateral bends that fit together, preventing longitudinal displacement.

VALVE REGISTERING DEVICE.—Charles L. Quimby, Philadelphia, Pa. For registering and indicating the opening as well as closure of gate or other valves, this invention provides a simple and practical device adapted to be connected with the movable gate or equivalent part of a valve, to indicate the position and register on dials the movements of the valve, so that any change may be seen at a glance by an inspector. Gearing within the valve casing and actuated by the valve stem is supported upon spindles on which are also graduated dials, an apertured face plate above the dials exposing but one graduation on each dial, while an index finger, by its movement toward either of the words "open" or "shut," indicates the position of the valve.

PAPER MAKING MACHINE.—George L. Bidwell, Warren Paper Mills, N. J., and Samuel C. Reynolds, Comstock's Bridge, Conn. For cylinder machines this invention provides improvements whereby the pulp is perfectly couched and waste and loss of pulp are entirely prevented, the deckles also being adjustable for any desired width of paper while the machine is in motion. The cylinder mould shaft is journaled in the vat in bearings which form outlets for water from the cylinder, and the mould is engaged on part of its periphery by two deckles made as endless rubber bands, the face next the cylinder being of soft or spongy rubber and its reverse of harder and smoother rubber, the deckles not passing between the cylinder mould and the couch roll, so that the latter is free to perfectly couch the pulp on the cylinder mould.

Railway Appliances.

CAR AND BRAKE PIPE COUPLING.—John W. Bryan, Quincy, N. C. A car coupling which is designed also to establish communication between the brake pipes of the adjoining cars when they are coupled is afforded by this invention, the drawheads having mortises into each end of which a tube extends and there being connections betwen the tubes and the fluid pipes. The drawbar fits into the mortises of the drawheads and is formed of a block tapering from the middle toward each end, with a longitudinal channel joining at its ends the tube ends of the drawheads, there being also notches along its upper side, and pin bars arranged to be held in the thickened portions of the drawheads and engaged by the notches.

Electrical.

TROLLEY HANGER.—Theodore Fletcher, St. Louis, Mo. According to this improvement the hanger is made of two ears secured to the trolley wire a short distance from each other, the ears being connected by a short section of wire which passes over a pulley whose shank is embedded in an insulated block to which the suspension wires are attached. The construction permits a slight longitudinal movement of the trolley wire, and the support is somewhat flexible, doing away with any tendency of the wire to bend or buckle.

Bicycles, Etc.

BICYCLE HOLDER.—John F. Bengert, Brooklyn, N. Y. To support bicycles in an erect position when not in use, according to this improvement, a clamp having a tubular transverse bearing is secured to the frame, sleeves having lugs turning in the bearing and the lugs being connected and arranged to turn together, there being rods slidable in the sleeves, and means for securing the rods adjustably in the sleeves, whereby the rods may be made to fold along the frame of the bicycle or swung out to engage the ground and afford fixed supports for it. The device is adapted to be conveniently attached to and detached from bicycles of all kinds, and when in place does not interfere in any way with the operation of the machine.

Miscellaneous.

RANGE FINDER.—George M. Searle and George N. Saegmuller, Washington, D. C. Two patents have been granted these inventors for a range finder for determining the distance of remote objects, such as an enemy's vessel at sea, one which will, by a simple adjustment, indicate at once, without calculation, the distance of a remote object on the scale of the instrument. It comprises a graduated base line bar having a fixed right angular reflecting surface and also a movable one with a pointer traveling on the graduated scale of the base line, the two reflecting surfaces being in different planes to throw their images on different portions of the object glass of a telescope constructed to bring the two images into coincidence. The readings on the scale are marked, according to one of the patents, by the adjustment of one of the prisms, the position and form of the refracting plate remaining constant, while, according to the other patent, the two prisms are fixed and the readings are taken by the radial adjustment of the refracting or coincidence plate by means of a pointer on a cotangent scale.

KINETOGRAPHIC CAMERA.—Leo Grubman, New York City. A photographic apparatus has been devised by this inventor to take in succession upon a ribbon film a series of pictures of a scene or moving object, each picture being separated from the next by a very short period of time, and the apparatus being also adapted for use as a lantern to project the pictures on a screen. The apparatus is inclosed in a lightproof box, and the mechanism is so proportioned that the ribbon is advanced by steps for spaces exactly equal to those occupied by each picture, the feed device preventing any possibility of scratching or injuring the surface of the film.

HAND-PROPELLED VEHICLE.—Ferdinand Damour, Bolckow, Mo. This invention is for a vehicle to be propelled by hand and guided by the feet, the car moved by the operator being also designed to draw after it another car of novel construction. The propelling car has front steering wheels journaled in brackets in which are also journaled vertical shafts carrying gear wheels, both of which mesh with a gear on a shaft carrying a pinion which meshes in rack bars on opposite sides of the car and adapted to be moved by the feet for steering the car, while crank handles, to be operated by hand, are connected by sprocket wheel and chain to rotate the short axles on which the drive wheels are mounted.

HORSE DETACHER.—Joute L. Bouma, Wanari, South Dakota. For detaching runaway horses from their vehicles and steering the vehicles while they move on from the momentum previously gathered, a shaft carrying a drum is, according to this improvement, journaled just behind the dashboard, and a cord passed around the drum is connected with spring-pressed pins which hold the whiffletrees, the pins being withdrawn by rotating the shaft by turning a hand wheel and the team thus released. A sprocket and chain gearing connection is also made with the front axle, whereby, on turning a handle bar, the vehicle may be steered.

BAG HOLDER.—John Littlejohn, Aurora, Ill. A combined bag and pail holder is provided by this invention for retaining in convenient readiness for use what are styled "oyster pails," and the paper bags commonly used for wrapping purposes. It comprises a frame, preferably of wire, having side sections to which the pail receivers are secured, while a bag clamp is held to and adjustable along one of the side sections or upon the front, as many of these clamps as desired being employed for holding different sizes of bags.

SINK DRAINING BOARD, ETC.—John Foran, Flemington, N. J. This is a device adapted to be readily and conveniently applied to any form of sink. A combined adjusting and supporting rod or arm is used in connection with a novel form of bracket, whereby the draining board may be dropped to a vertical position below the top of the sink or carried to and supported in a horizontal or inclined position, with any desired inclination in the direction of the sink.

DESIGN FOR A SINK.—Robert M. Johnson, Hainesport, N. J. This sink has in one of its bottom corners a corner pocket, with semicircular or segmental front, the bottom of the pocket, on the inside, being a little distance above the sink bottom.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS, ETC.

THE MAMMOTH CAVE OF KENTUCKY. By H. C. Hovey and Richard E. Call. Louisville, Ky.: John P. Morton & Company. Pp. 108. Price, paper, 50 c.; cloth, $1.

This is an attractively got up illustrated manual, with maps and many fine half tones, designed to afford the reader as complete an idea as possible, through words and pictures, of the beauty, grandeur, and sublimity of this most wonderful of caves. Readers of the SCIENTIFIC AMERICAN will doubtless remember some of the highly interesting and delightful descriptions of the Mammoth Cave which Mr. Hovey has heretofore written for our columns, and will therefore be prepared to welcome in this manual a complete and exhaustive treatment of the subject. Those who visit the cave can but poorly afford to do without having the book as their guide, and for those who cannot make the visit the manual affords much the best account yet published.

BLOCK SIGNAL OPERATION. A practical manual. By William L. Derr. New York: D. Van Nostrand Company. 1897. Pp. 270. Price $1.50.

This is a practical work by the superintendent of the Delaware division of the Erie Railroad. Its aim is to present the latest practice in block signal operation that obtains in this country and in Europe. It appears to be a thoroughly practical work and cannot but prove of interest and value to all those who are interested in the safe running of railway trains. The complicated system of interlocking at junctions is illustrated in very clear diagrams.

SIXTH ANNUAL REPORT OF THE BUREAU OF LABOR, STATISTICS AND MINES. To the Governor and Fiftieth General Assembly of the State of Tennessee. 1896. A. H. Wood, Commissioner and Labor Inspector of Mines. Nashville: Franc. M. Paul, Printer to the State. 1897. Pp. 310.

BULLETIN OF THE GEOLOGICAL INSTITUTION OF THE UNIVERSITY OF UPSALA. Edited by Hj. Sjogren. Vol. II. (1894–1895.) Upsala. 1896. Pp. 372.

A. D. LECTRA'S SHORT CUT CALCULATOR. Containing the most practical methods of business calculation. Pp. 108. Price $1.

The author is a professional accountant and calculator, and is therefore in a position to give practical advice regarding the relation of mathematics to business transactions. A large number of excellent short cuts are given, with illustrative examples. The author claims nothing new in the principles involved, only in the method of presentation.

CANOE CRUISING AND CAMPING. By Perry D. Frazer. Illustrated. New York: Forest and Stream Publishing Company. Pp vii, 87. Price $1.

This is a handsome little book, beautifully illustrated with well taken and well printed half tones. The author is evidently well versed in the subject, and all those who are in any way interested in the delightful sport of canoeing will find many kinks which will tend to secure their comfort.

THE DRAMATIC MAGAZINE. Chicago: Dramatic Magazine Press. Price $2.50 a year.

This is a new monthly publication devoted to theatrical and operatic subjects, copiously illustrated with half tone engravings of the most celebrated actors and actresses of the present day, and many full page scenes from plays which are being acted in this country and in Europe.

ELEMENTS OF ELECTRO-CHEMISTRY TREATED EXPERIMENTALLY. By Dr. Robert Lüpke. With 54 figures in text. London: H. Grevel & Company. Philadelphia: J. B. Lippincott Company. 1897. Pp. xv, 223. Price $2.50.

The present time is most opportune for bringing together the recent results of electro-chemistry in condensed form. The present work gives an excellent short survey to those who are not in a position to make an exhaustive study of the voluminous literature of the sub-

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ject for themselves. The experiments which form the central part of the book are carried out with the simplest possible apparatus. Although the main purpose of the book is to set forth the purely scientific aspects of electro chemistry, the practical side of the subject has not been left altogether unknown. Technical electro-chemical processes, especially the processes of electro-metallurgy, which is so important at]present, are referred to in their proper places. It is a work of great value to all professors and students of chemistry.

Woodworkers' Tools (400 pages, price $1), by Charles A. Strelinger & Company, of Detroit, Mich., is a good deal more than an ordinary catalogue; for, in addition to its numerous illustrations of tools and machinery, it gives a great deal and a wide variety of practical information relative to their employment, well calculated to assist the workman or apprentice. It includes tools used by carpenters, builders, cabinet makers, pattern makers, millwrights, carvers, and ship carpenters, as well as implements for draughtsmen, etc. A supplementary chapter is designed to place before the practical mechanic simple illustrations of the first principles of geometry.

SCIENTIFIC AMERICAN BUILDING EDITION

AUGUST, 1897.—(No. 142.)

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No. 1. Two perspective elevations (one in colors) and floor plans of a cottage at Binghamton, N. Y., recently erected at a cost of $3,500 complete. Mr. Elfred Bartoo, architect, Binghamton, N. Y. An attractive design in the English style.

No. 2. A cottage at Scranton, Pa., recently erected for Mr. E. Healy, at a cost of $7,000 complete. Perspective elevation and floor plans. A modern design well treated. Mr. Edward H. Davis, architect, Scranton, Pa.

No. 3. A residence at Prohibition Park, S. I., recently erected for Mr. J. W. Hoban, at a cost of $3,300 complete. Excellent design of modern American style, with Colonial treatment and detail. Mr. John Winans, architect and builder, Prohibition Park, S. I. Two perspective elevations and floor plans.

No. 4. A suburban school house at Overbrook, Pa., designed to resemble a private residence instead of a public building. An exceedingly attractive design. Mr. William L. Price, architect, Philadelphia, Pa. Two perspective elevations and floor plans.

No. 5. Residence at Larchmont, N. Y., recently erected for Mr. Henry A. Van Liew. Pleasing design, with many excellent features. Two perspective elevations and floor plans; also a view of stable, with ground plan. Mr. H. C. Stone, architect, New York City.

No. 6. Cottage at Clinton Township, N. J., recently erected for the Protective Building and Loan Association, at a cost of $1,500 complete. Two perspective elevations and floor plans. Messrs. Hobbs Brothers, architects, Newark, N. J. A neat design.

No. 7. A residence at Larchmont, N. Y., recently erected for Miss Flint. Two perspective elevations and floor plans. The design presents a good, modern, sensible house of pleasing appearance, treated with Colonial detail. Messrs. G. E. Harney and W. S. Purdy, architects, New York.

No. 8. Residence at Prince's Bay, Staten Island, recently erected for A. W. Browne, at an approximate cost of $8,000. A rustic design of much artistic merit. Perspective elevation and floor plan. Mr. F. W. Beall, architect, New York City.

No. 9. Cottage at Forest Hill, N. J., recently completed for Mr. Charles W. Clayton, at a cost of $3,800 complete. An attractive design. Perspective elevation and floor plan. Mr. H. Galloway Teneyck, architect, Newark, N. J.

No. 10. Residence at Evanston, Ill., recently erected for Mr. C. B. Congdon. A substantial and dignified design. Two perspective elevations and floor plans. Messrs. A. M. F. Colton & Son, architects, Chicago, Ill.

No. 11. A pulpit of the Cathedral of Treves. Half page engraving.

No. 12. Washington Monument, Philadelphia. Presented to the city by the State Society of the Cincinnati and unveiled by President McKinley. One of the most important and imposing monuments ever erected in the United States. Cost $250,000. Designed by Mr. Rudolph Siemering, the German sculptor.

No. 13. Miscellaneous Contents: Palais Royal to be demolished.—Largest hotel on earth.—A quick piece of work.—Drawing materials, surveyors' instruments, etc.—Statue of Mercury at the Nashville Exposition, illustrated.—Compoboard.—Improved heaters and furnaces, illustrated.—Stair builders' goods.—Architects' and builders' directory.

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Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7189) E. G. A. asks: Please say in what number of your paper I can find instructions for making a kite without a tail. A. Valuable illustrated articles on the construction and flying of tailless kites will be found in SCIENTIFIC AMERICAN, Nos. 20, vol. 55; 12, vol. 58; 10, vol. 70; 11, vol. 71; 11, vol. 74; 4, vol. 76; also SUPPLEMENT, Nos. 583, 1013, 1016, 1070. Price 10 cents each prepaid by mail.

(7190) W. H. asks: 1. In making the eight light dynamo described in SUPPLEMENT, No. 600, could not the armature core be built of thin disks of iron, extending to the shaft, or could the wooden sleeve be replaced by one of brass? A. The armature core may be built of disks of the softest sheet iron about one-twentieth inch in thickness. These are sometimes perforated for ventilation. The disks are to be separated from each other by similar disks of thin paper or they may be oxidized. This prevents eddy currents through core. They may be keyed to the shaft or fastened together by bolts. No metal other than iron should be used in core, since iron alone has magnetic value. 2. Has an alternating current P. and N. poles? It seems to me, if the current were rapidly reversed, there would be no poles. A. The poles reverse two or more times with every revolution of the alternating dynamo, and no effort is made to name them. 3. What is meant by consequent and salient poles? A. Consequent poles are poles formed in the length of a magnet, and alternating in sign. In field magnets, salient poles are those projecting from the main body of the field magnet.

(7191) D. K. writes: I wish to light a 6 candle power 9 to 12 volt lamp for about 4 hours per night. I have 6 storage cells of 5 plates each, plates 6×8 inches. 1. How many Grove, Bunsen or Daniell batteries would it take to charge the above? A. Use 15 Daniell or gravity cells, or 10 Grove or Bunsen. 2. Which of the above batteries is the most suitable? A. Daniell or gravity. The others both give off corrosive vapors and must be kept out of doors or in a box outside of a window. 3. Would smaller plates in the storage battery be better? A. If the cells are of any of the standard makes, they could be cut down to about half the original size. To determine this, remove one pair of plates from each cell and find the amperes the battery will give as compared with full size. Then cut down the plates proportionally.

(7192) J. J. R. asks: 1. What does a dry battery consist of? How is it made up? Give me all the facts and what powders to use to bring out the electric spark. This must be a dry battery and a small one. Give me the cost of its make up. A. There are no dry cells, that is, cells containing only dry powders. The so-called dry cells are usually Leclanche cells in type. They are made with a rod or strip of zinc and a plate or cylinder of carbon. These are immersed in a paste composed of a saturated solution of sal ammoniac in water, into which plaster of Paris, gelatine, or some other substance is stirred till the liquid is held so that it will not run out if the cell is upset. In a sense it is dry. The cost depends on size, materials and make-up. It is not possible to give figures. See a valuable paper on dry cells in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1001, 10 cents. 2. Also give me a few principles of how to deal with pyro-electricity of certain minerals possessed with the electric heat and form a brush glow spark. A. There are no minerals which give out electric heat and a glow spark with pyro-electricity. Tourmaline, boracite, and other minerals may be electrified by heating so as to attract light bodies to their ends, in a manner similar to rubbed sealing wax. Mica will glow in the dark on being suddenly split, and a lump of sugar will do the same on being crushed or cracked. A piece of card will give out sparks on being torn asunder in the dark. See S. P. Thompson's "Lessons in Electricity," Pp. 77–80. 3. Also if magnesium wire can be used possessed of heat, and can be controlled. A. Magnesium ribbon is burned in a lamp invented for that purpose, with full control. Apply to some dealer in physical apparatus.

(7193) A. J. C. asks for a recipe for making white metal. A. White metal is made by a number of formulas. It depends upon the use to which it is to be put. Try the following: Tin, 9 ounces; lead, 2 ounces; antimony, 1 ounce; bismuth, 2 ounces.

(7194) R. H. D. asks: How can I fasten cloth to brass or zinc? A. Use equal parts of pitch and gutta percha melted together and used hot. The following formula has also been recommended for the purpose: Gutta percha, 16 parts; pure, unvulcanized rubber, 4 parts; pitch, 2 parts; shellac, 1 part; linseed oil, 2 parts. Digest the rubber in the linseed oil; melt the gutta percha, pitch and shellac and add the digested rubber.

(7195) E. A. B. says: Please answer the following in your query column: In using a Baume hydrometer for acids at 60° F. in a diluted solution of 2 or 3 per cent acid, what is the variation of the hydrometer reading when the thermometer reading in the solution is over 60° up to 80° or 90°, for instance? A. The small amount of acid in solution 2 or 3 per cent will change the density of the water very little. The density of a 5 per cent solution in pure water is 1·033. Hence the change of hydrometer reading is practically that which is produced by change of temperature, and this is very little for a change from 60° to 80°. Not as much as 1 on Baume's scale. The temperature was not considered in making the Baume scale. You can easily determine the matter experimentally. Bring your liquid below 60° and heat it very slowly, stirring to keep it uniform in temperature throughout. Observe both thermometer and hydrometer and record the readings of hydrometer for temperatures from 60° to 80°, or, in fact, as high as you need in your work. You will then have a table of corrections for your hydrometer.

(7196) N. E. S. asks: Will you please publish, in "Answers to Queries" in SCIENTIFIC AMERICAN, the formula for making the hectograph? I have been a reader of this valuable publication for over three years past. I have noticed this formula in one of my papers, I think, but, as some of my papers were accidentally destroyed, I lost the formula. A. Formulas for hectograph compositions are given in our SUPPLEMENT numbers 438, 1092 and 1110, which we can supply at 10 cents each.

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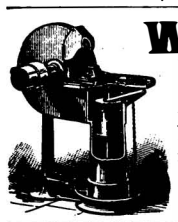

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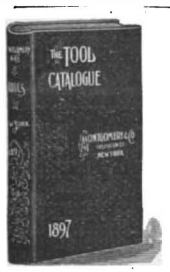

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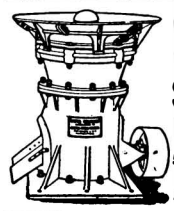

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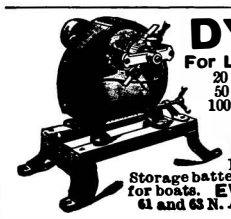

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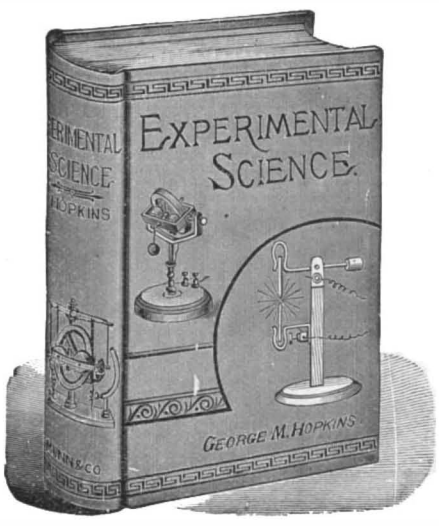

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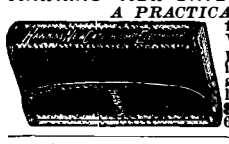

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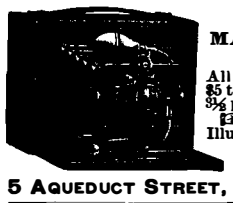

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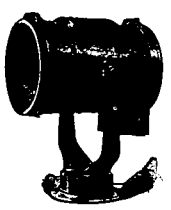

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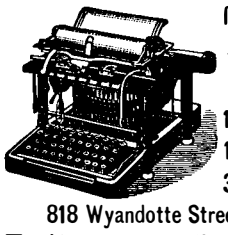

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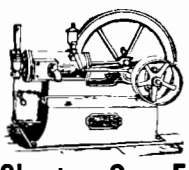

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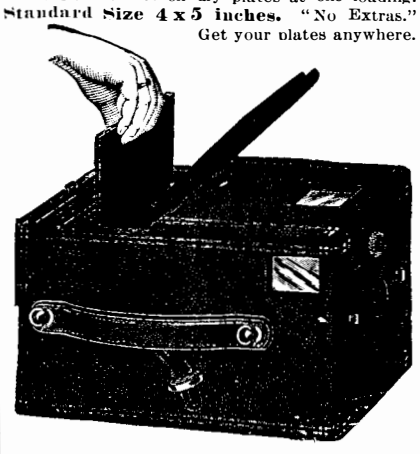

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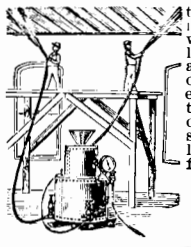

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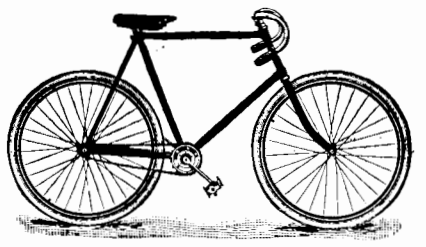

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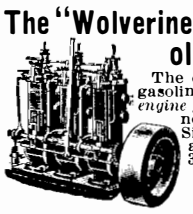

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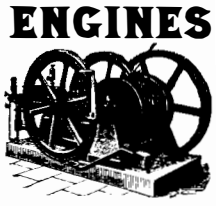

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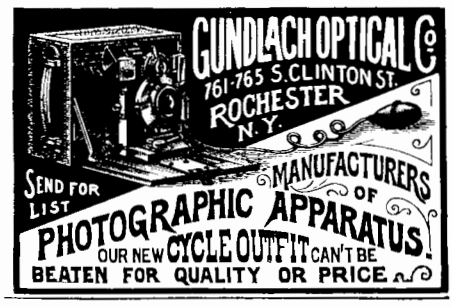
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